Handling Ethanol In Terminals

Kathy West
Product Specialist
PFT/Alexander Service, Inc.
Signal Hill, CA

PFT/Alexander

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ETHANOL

COMPLETE HANDLING SYSTEMS
TURN KEY

- Process Equipment
- Additive Systems
- Fabrication
- Calibration
- Valves
- Vapor Handling
- Denature Systems
- Truck Loading / Unloading Systems
- Railcar Loading / Unloading Systems
- Control Systems
- Grounding / Overfill
- Temperature
- Measurement
- Service
- Level
- Pressure

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BioDiesel

COMPLETE HANDLING SYSTEMS
TURN KEY

- Process Equipment
- Additive Systems
- Fabrication
- Calibration
- Valves
- Vapor Handling
- Density / Product Quality Monitoring Systems
- Truck Loading / Unloading Systems
- Railcar Loading / Unloading Systems
- Control Systems
- Grounding / Overfill
- Temperature
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- Service
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PFT/Alexander Inc.
Associated Affiliations

PFT/Alexander Service, Inc.
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Toll Free (800) 696-1331 - (562) 595-1741 - Fax (562) 424-3633

ATTB (Alcohol, Tobacco, Tax Trade, Bureau)

(formerly ATFB)

Federal Regulations for Producing Alcohol

Alcohol DSP Regulations

- Operating Permit under 26 U.S.C. 5171(d)
- Distilled Spirits Bond
- Permit for an Alcohol Fuel Producer under 26 U.S.C. 5181

These permits are required, or penalties given. The system part of your operation should be designed to comply with these requirements.

To Bond –

ie. You must comply with all requirements of law and regulations, now or hereafter in force, pertaining to all distilled spirits (including denatured spirits, fuel alcohol and articles) removed from or returned to the bonded premises free of tax.

ATTENTION

Effective June 1, 2000, all technical service activities relating to your operation will be handled by the National Revenue Center in Cincinnati, Ohio. Please file your ATF applications, bonds, reports, correspondence, claims, and other related documents with the National Revenue Center located in Cincinnati, Ohio. The address and telephone number and fax of this office are:

Bureau of Alcohol, Tobacco & Firearms
National Revenue Center
8002 Federal Office Building
550 Main Street
Cincinnati, OH. 45202-3263
Telephone: 1-800-398-2282
Fax: 513-684-3168

Any Excise Tax Return, ATF Form 5000.24 that you file on or after June 1, 2000, should be mailed to the following address that changes the post office box and zip code that you are currently using. The new address is:

Bureau of ATF
Excise of Tax
P.O. Box 360958
Pittsburgh, PA 15251-6958

PLEASE NOTE: You should continue to send your Special Tax Registration and Return, ATF F 5630.5 to the address indicated on the back of the of that form.

In lieu of showing the proof gallons of spirits on daily transaction records of withdrawals from bonded premises, proprietors may show the wine gallons or liters and the proof of spirits in cases. Summary records shall be used to compile the report required by §19.792.

(Sec. 807, Pub. L. 96–39, 93 Stat. 283, as amended (26 U.S.C. 5207))

§19.752 Denaturation records.

(a) *General.* Each processor qualified to denature spirits shall maintain daily records of denaturation showing:

(1) Spirits received for, and used in, denaturation;

(2) Spirits, denatured spirits, recovered denatured spirits, spirits residues, and articles redistilled in the processing account for denaturation;

(3) Kind and quantity of denaturants received, used in denaturation of spirits, or otherwise disposed of;

(4) Conversion of denatured alcohol formulas in accordance with §19.460;

(5) Denatured spirits produced, received, stored in tanks, filled into containers, removed, or otherwise disposed of;

(6) Recovered denatured spirits or recovered articles received, restored, and/or redenatured;

(7) Packages of denatured spirits filled with a separate record for each formula number and filed in numerical order according to the serial number or lot identification number of the packages;

(8) Losses; and

(9) Disposition of denatured spirits.

(b) *Record of denaturation.* Each time spirits are denatured, a record shall be prepared to show the formula number, the tank in which denaturation takes place, the proof gallons of spirits before denaturation, the quantity of each denaturant used (in gallons, or in pounds or ounces), and wine gallons of denatured spirits produced.

(Sec. 807, Pub. L. 96–39, 93 Stat. 284 (26 U.S.C. 5207))

§19.753 Record of article manufacture.

Each processor qualified to manufacture articles shall maintain daily records arranged by the name and authorized use code of the article to show the following:

Customers / Users of Denatured Alcohol

Concerns

•Identify Source – Verify Quality Control of Ethanol

•Customers contract with supply source should cover the product quality specific to

- •Alcohol Product Proof – ATTB
- •Product specific gravity before / after denaturing
- •Denaturing Product Spec
- •Certificate or test data on water concentration

•Transportation – Clean tankage to insure no contamination

•True and accurate measurement of all components in Ethanol Product not just denaturant but any anti corrosives or anti static additives.

•Proving the measurement regularly to insure accurate measurement numbers.

•MSDS Sheets with delivery.

Automatic Denaturing of Alcohol

In the past tank gauges were used for Alcohol when one tank was transferred into another tank previously filled with a quantity of the denaturant, than mixed to blend.

Issues:

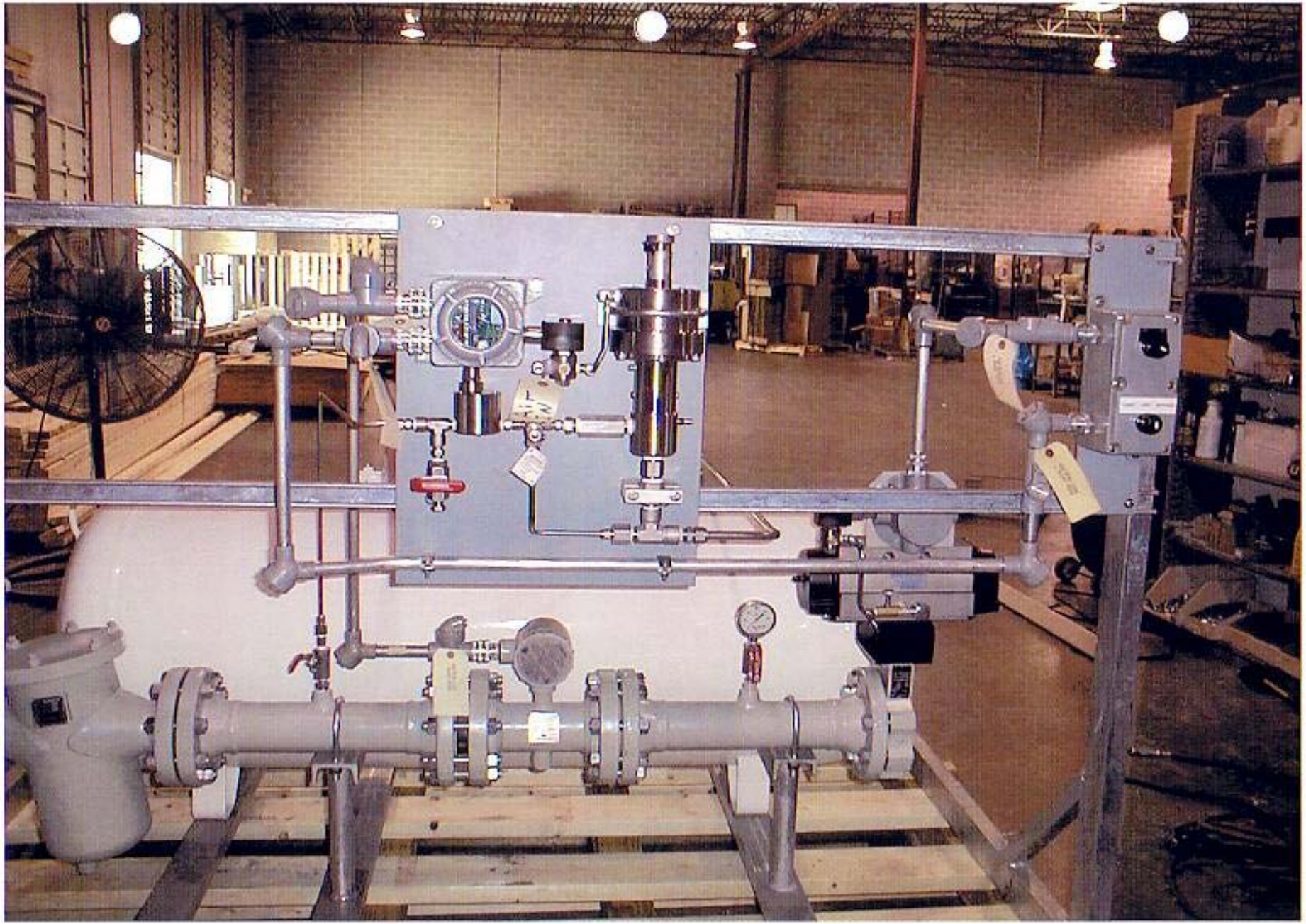
- Accuracy of the tank gauge on large tankage trying to denature at 2-5% of volume.
- Due to the molecule differences of Gasoline and Ethanol can you get a true blend or will you have stratification issues.
- If a two tank system is used you are dependent on having enough space for production handling that allows you accuracy on your blend, and record keeping to track.
- With the growth / shrinkage issues of Ethanol the volume will shift and cause you variances on volume record keeping.

Automatic Micro Blender System Options

As the Alcohol process is complete and the transfer to storage begins:

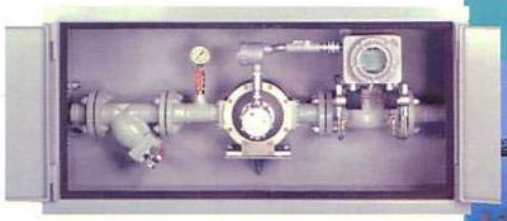
New Option:

- Have a Micro Blender wired to the Alcohol process line hi accuracy meter.
- This Micro Blender system will pace this flow into the storage tank. It will automatically record the Alcohol volume while controlling a valve and meter on the denaturant line insuring accuracy. This system will record the Alcohol volume, denaturant volume have alarm capabilities to advise any deviation in the blend tolerances. This is a Skid Mounted Complete System.
- Once this “batch” or “tank” volume is reached you have the ability to down load the information into your record keeping as mandated by the ATTB.



LUBRIZOL
Performance Systems™

The Micro-Blend ™ System is an intelligent Blend Controller which makes use of the latest advancements in microprocessor technology to bring unparalleled accuracy to blending applications.



Micro-Blend system

The Micro-Blend System utilizes two product streams, the monitored stream is referred to as the Wild Stream, and the controlled stream is referred to as the Blend Stream. The Micro-Blend controller monitors the Wild Stream and controls the Blend Stream to the programmed blend ratio. The Micro-Blend Controller is designed to be cost effective and simple to operate, yet provide control accuracy previously only found in expensive and complicated systems.

Features

- Blend Stream product factored pulse output
- Wild Stream and Blend Stream product totals
- User-definable alarm conditions
- Smith (Type I), Brooks (Type II) and Modbus (Type IV) Protocol
- Infrared Hand-Held Controller
- EIA 485 (2-wire) communications at 1200/2400/9600/19,2000 baud
- Backlit LCD (Liquid Crystal Display) with 2 lines by 14 characters
- Internal watchdog low power protection
- 4 levels of password security (8 users definable)
- Built-in proving preset

Applications

- Oxygenate Blending
- Mid-grade Blending
- Marine Oil Blending
- Analytical Blending
- Asphalt Blending
- 1 GPM - 3000 GPM

LUBRIZOL
Performance Systems™

Electrical Inputs

- AC Instrument Power: 120/240 VAC +/- 15%, 48 to 63Hz.,1.0A maximum or 240 VAC +/- 15%, 48 to 63 Hz
- Current Consumption: <50 mA. @120 VAC/ <25 mA @ 240 VAC
- AC circuitry is fuse protected (Does not include inputs or outputs)
- Surge current 10A maximum for less than 0.1 seconds
- One (1) Optically isolated, AC solid state triac input (permissive input)
- Load voltage range: 90 to 280 VAC , 48 to 63 Hz.
- Steady state load current range: 0.05A (rms) minimum to 5A (rms) maximum into an inductive load
- Leakage Current @ Maximum Current rating: 100 microamps maximum @ 240 VAC
- Duty Cycle: 40/60 to 60/40 (on/off)

Pulse Input

(Pulses per Gallon / Liter / etc.)

- Type: DC
  Maximum Pulse Rate: 5 KHz
- Minimum 10 pulses per unit

Electrical Outputs

- Three (3) Optically isolated, AC solid state triac outputs (2 used for digital valve control -1 for alarm output)
- Load voltage range: 90 to 280 VAC , 48 to 63 Hz.
- Steady state load current range: 0.05A (rms) minimum to 5A (rms) maximum into an inductive load
- Leakage Current @ Maximum Current rating: 100 microamps maximum @ 240 VAC
- Duty Cycle: 40/60 to 60/40 (on/off)

Pulse Output

- Open Collector Transistor
- 1, 1/10th, 1/100th, 1/1000th unit volume, or unfactored pulse output available

Display

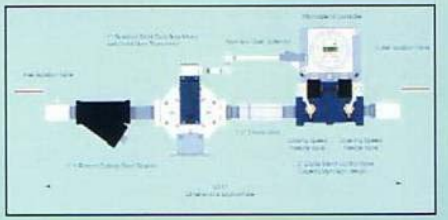
- Module Format: 2 Line by 14 position display
- Type: Liquid Crystal Display Backlit
- Character Format: 5 by 7 dot matrix type

Environmental

- Ambient Operating Range: -40°F to 150°F (Display may appear slow at temperatures below 0°F)
- Humidity: 5 to 95% without condensation

Communications

- General Configuration: Multidrop Network. 32 Micro-Blend™ Systems may be connected to the same host
- Data Rates: 1200/2400/9600/19,200 Baud rate supported
- Data Format: 8 data bits/No parity/1 stop bit
- Type: Interfaceable with EIA-485 (2-wire) data communication standard



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Fareham, UK PO16 8XU
Tel +44 1329 825 823 Fax +44 1329 825 824

www.lubrizol.com

Automatic Additive Injection

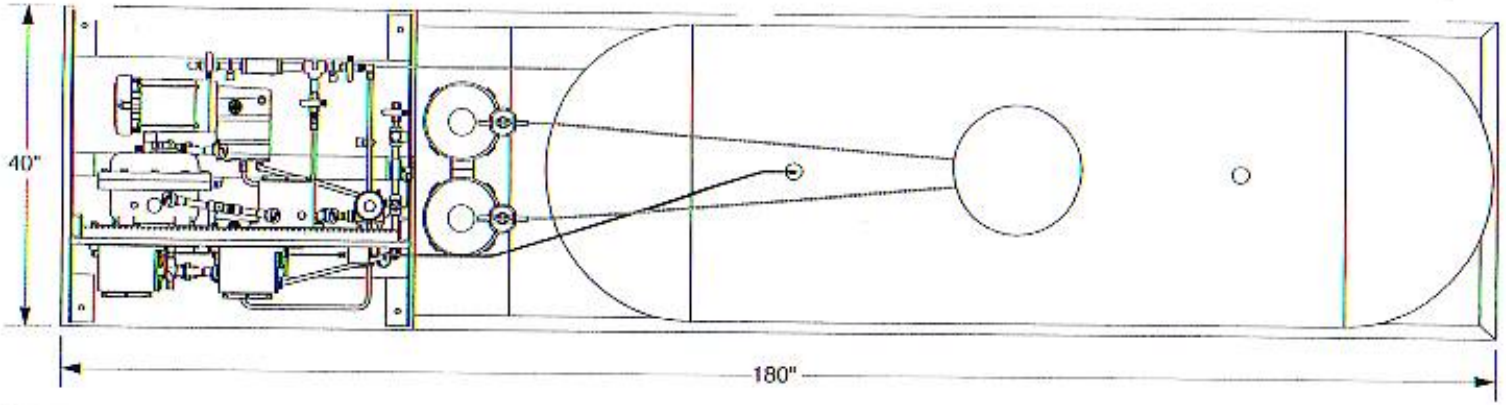
In some cases your specifications will call for the addition of other Chemical Additives.

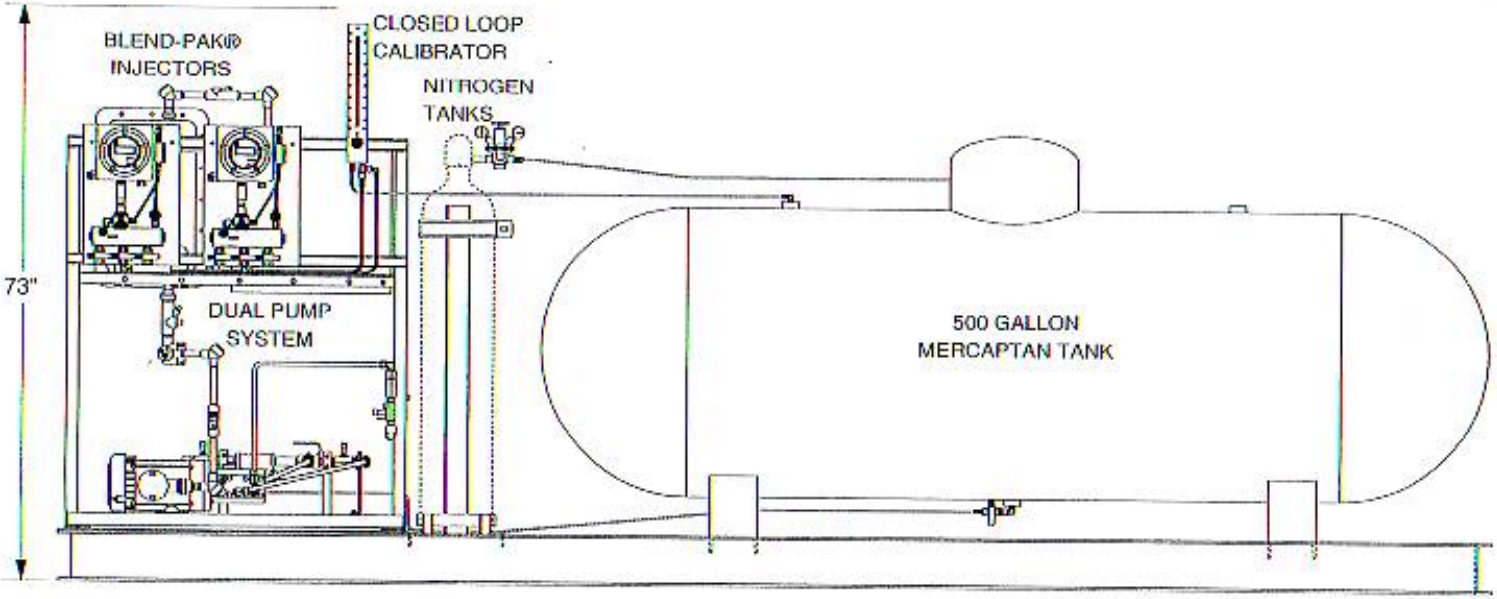
- Anti Corrosive

- Anti Static

- PH Buffers

This can easily be accomplished by using the Automatic Additive Injection panel. This unit can be fully self contained including pump, motor starter, communications Micro Processor, Skid mounted. Again this unit will keep the volume of product from the product meter (Alcohol) and the volume of additive on a per batch or transfer to storage process, programmable alarms are used to insure product specifications.





NOTE: ALL DIMENSIONS ARE APPROXIMATE
DUE TO MANUFACTURING DISCREPANCIES

GATE CITY EQUIPMENT CO., INC.
ATLANTA, GA

MERCAPTAN INJECTION SYSTEM

DATE	8/10/07	DRAWN BY	A. THOMPSON
SCALE	NONE		
DRAWING NUMBER	15-97A55		

LUBRIZOL
Performance Systems

Lubrizol Performance Systems™ is proud to present the Mini-Pak™ 2000 Injector.

Incorporates a virtual leak proof metering/ control manifold design with an enhanced Mini-Pak Control Module. The result is the most advanced technology additive injector on the market.

Mini-Pak™ 2000 Injector

Reducing the Burden of Ownership

Injector Manifold Features

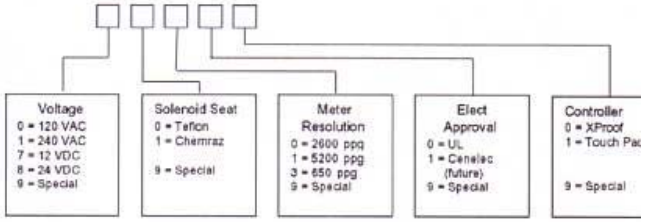
- Stainless steel construction
- Precision Oval Gear Meter machined into manifold block
- Standard version with 538 Ryton gears, up to 3 GPM
- Optional half height gears with double resolution
- Standard Teflon ASCO solenoid valve machined into manifold block
- Optional Chemraz ASCO solenoid valve
- Inlet Strainer and outlet check valve machined into manifold block
- Inlet and Outlet isolation/flow control needle

Standard Mini-pak Controller Features

- Mounted in explosion proof enclosure
- 2 line by 14 position back lit liquid crystal display
- Ambient operating range of -40°F to 140°F
- Hand-Held IR programmer interface
- Smith AccuLoad, Brooks, IMS, and Modbus protocols
- 4 level 8 password security
- Special control algorithm for automatic injection correction
- Alarms for no additive flow, additive cycle volume, and leaking solenoid
- Automatic calibration of additive meter
- Smith Meter Smart Additive Communications

LUBRIZOL
Performance Systems

In an ever-changing industry, innovation is the key to success. Lubrizol Performance Systems™ continues to lead the industry with the Mini-Pak 2000 Injector.



lectrical Specifications

Available with 120 VAC, 240 VAC, 12 VDC, and 24 VDC power
Available with UL or Cenelec approvals
AC or DC input pacing pulses
AC maximum rate of 100 pulses per minute
DC driving circuit must sink to within 0.8 volts of DC ground and signal must rise to 4.5 - 30 VDC. Maximum rate of 5 kHz
Triac AC or Open Collector DC output for alarm, feedback, or pump control
DC factored additive pulse output
Optional 4 - 20 ma pacing input
12 VDC supply for transmitters or converters
RS485 2-wire communications
Up to 32 injectors in multi-drop network
2-wire twisted pair RS485 communication cable required

Mini-Pak 2000 shown with Touch Controller Configuration

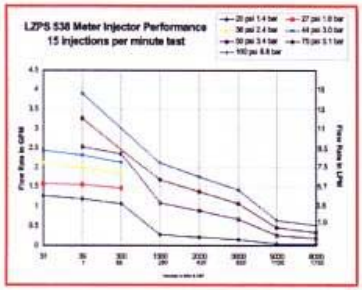
Hand-Held C

jector Port Connections

UL - 3/8" NPT (F)
Cenelec - 1/4" NPT (F)

ptional Accessories

P/N 10-31050 IR Hand-Held Controller
P/N 10-31565 Mono-Block II calibration kit
P/N 10-34020 COM I Software package for using a laptop to program modules



lonoblock Mechanical Specifications

303 stainless steel block
ASCO explosion-proof solenoid machined into the block with Chemraz seat
Combination isolation and flow control valves on inlet and outlet
Quick Connect test port intergrated in the block with Viton Seal
All other elastomers are Teflon or Teflon encapsulated silicon
Optional all Kalrez/Chemraz seals are available
Two meter sizes available standard with Ryton Gears:
Model 538 oval gear meter(flow range .3 to 3 GPM) nomimal K-factor 2600
Model 538.5 Oval gear meter (Flow Range .1 to 1 GPM) nominal K-factor 5200 Pulses per gallon
Optional stainless steel gears available

LUBRIZOL
Performance Systems

Our Mag-Drive Pump systems offers ultimate security for critical applications.

Pump Assembly

Reducing the Burden of Ownership

Features

- Offers a variety of pump assemblies designed to meet your requirements
- Single or Dual configurations
- Appropriate piping, motor controller, and conduit
- Assembly only requires field piping & power to the stater
- Dual pump assemblies offers two sequential controllers: PS-1 & PS-2

Operation

Normal - Field wiring should be provided to activate the pump control when any additive permissive in on.

Dual Pump operation with PS-2 Controller - When the pump control activated, the PS-2 controller starts pump A, and the next time pump B. If continues to alternate pumps, as long as both pumps are operable. Manual selection of either pump can be made at any time.

Dual Pump operation with PS-1 Controller - Normal operation is the same as the PS-2 Controller. The PS-1 provides a field adjustable time delay for shutdown of the individual pump, and lights indicating proper operation or failure mode. An alarm output terminal is activated on any failure situation in both models.

LUBRIZOL
Performance Systems

Style
- Positive displacement pumps are recommended for additive injection applications to provide sufficient pressure under varying hydraulic conditions. Magnetic drive pump assemblies with no dynamic seals are strongly recommended.

Manufacturers
- Roper, Viking, and Tuthill in certain models and sizes are available from Lubrizol Performance Systems inventory; other models and sizes available.

Motors
- Explosion proof for Class 1, Division 1, Group D locations; other ratings are available. Single phase to 1 HP and three phase 1/2 HP and larger, dual voltage, 50 or 60 Hz.

Tubing and Piping
- Stainless steel tubing and carbon steel tube fittings, or carbon steel pipe, with carbon steel threaded fittings. Schedule 80 steel piping. Optional socket welded systems are available.

Valves
- Carbon steel plated ball valves. Consult factory for other materials. Valves are configured to isolate pump.

Strainer
- Y-pattern ductile iron with a 20 mesh basket, installed in inlet piping.

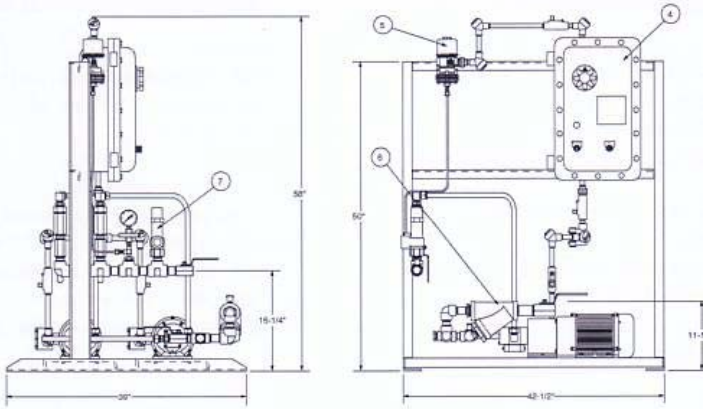
Pressure Gauge
- Liquid filled 0 - 300 psi range stainles installed in inlet piping.

Relief Valve
- External hydraulic system design, fac opening at 115 psi, and fully open at 12 setting is field adjustable. Carbon ste stainless steel piston with cross slot, metal seat.

Mounting
- Steel channel base, sand blasted anc epoxy primer and finish.

Optional Rack
- Fabricated steel, sand blasted and pa primer and finish. Pump assembly is r rack base, and the rack has space fc controller and a limited number of inj

Motor Controller
- Magnetic with adjustable circuit pro same device can be used with the r as 7.5 HP. Housed in an explosion Controllers for larger motors are avai



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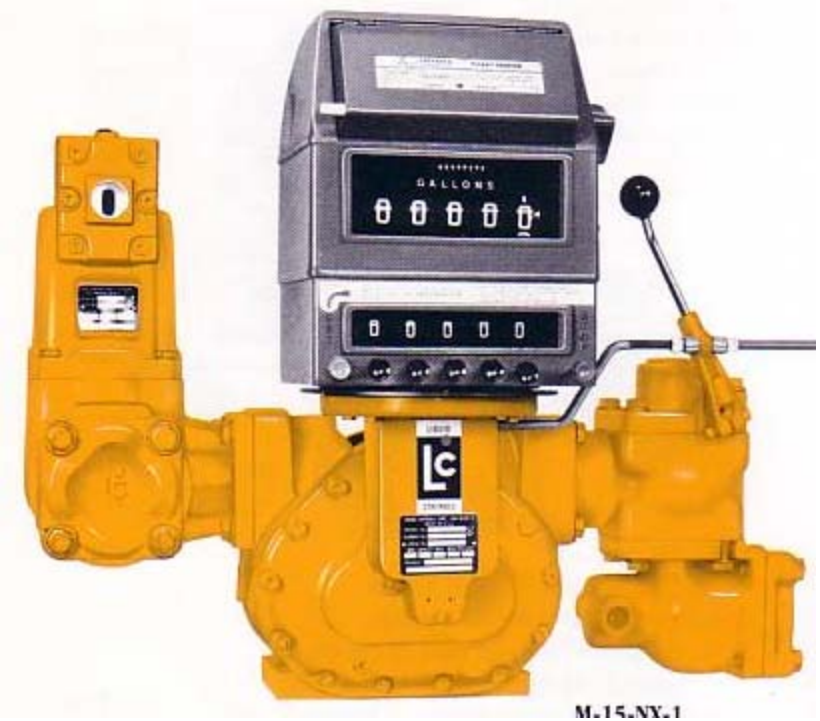
- **Lubrizol Performance Systems Ltd.**
  6 Pennant Park, Standard Way, Fareham, UK
  Tel +44 1329 825 823 Fax +44 1329 825 824

Getting Ethanol To The Gasoline Blending Terminals

Loading into clean Ethanol Carriers – Top or Bottom Trucks, Rail Car, Barge/Ship all can be skid mounted or site fabricated.

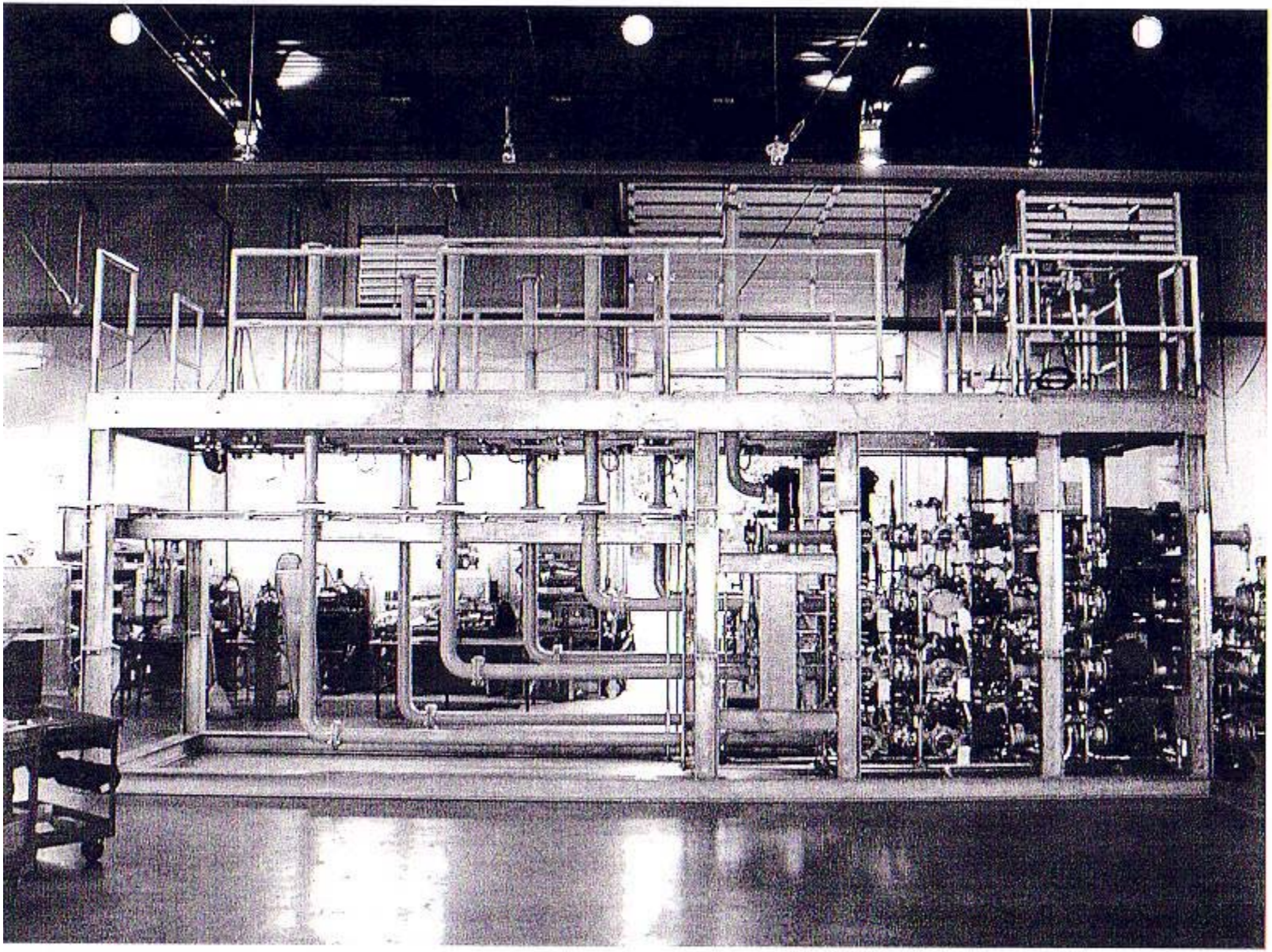
- Simple Mechanical Systems can measure with local totalization compensated (net) or non-compensated (gross) have either mechanical or electric valve and pump control, mechanical ticket for D.O.T. Product Delivery. (B.O.L.)

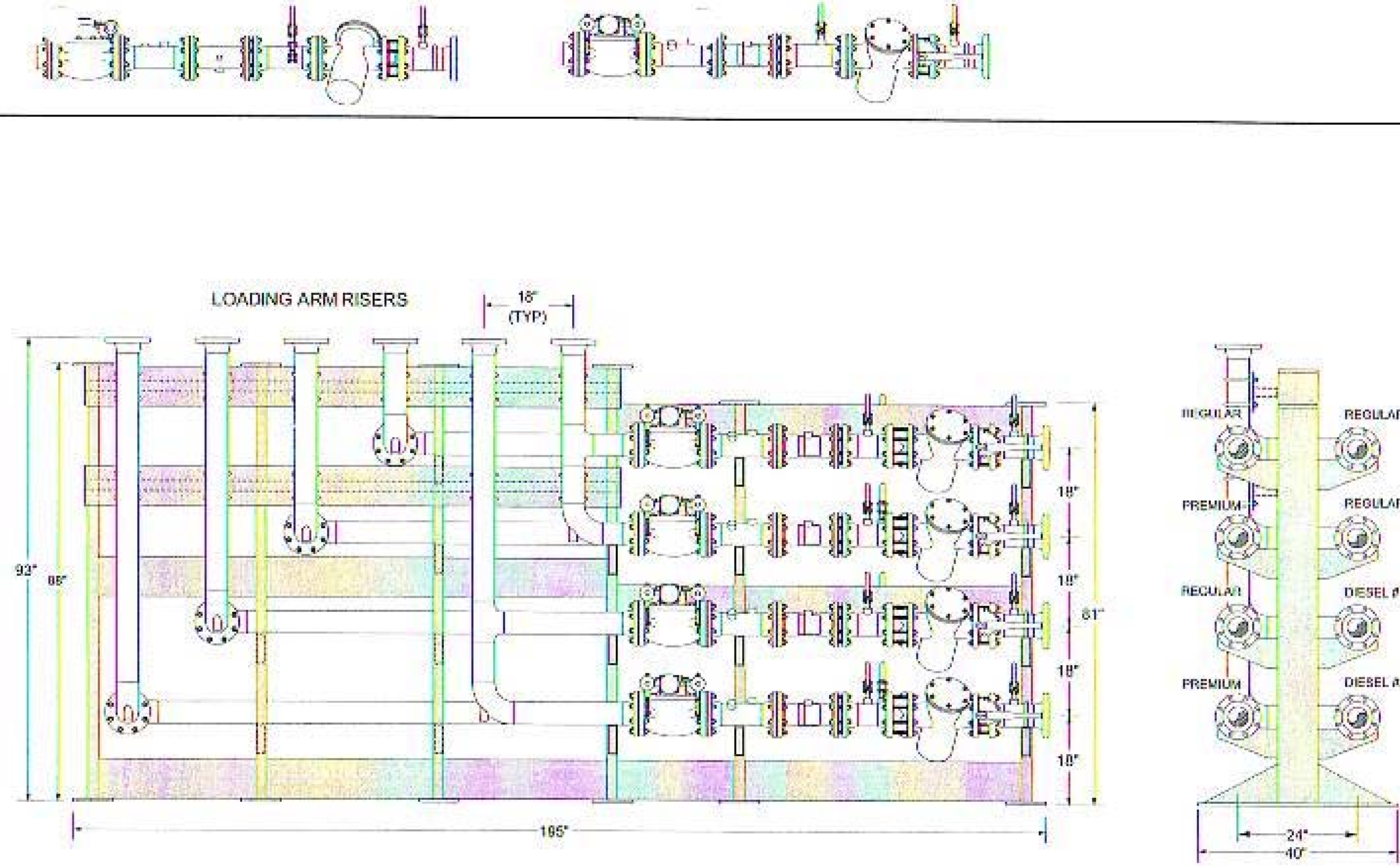


M-15-NX-1

Complete Loading System

- Most sophisticated systems can also be skid mounted with complete electronic controls.
- Pump Start / Stop
- Monitoring Meters
- Monitoring / Control of Valves
- Static Grounding / Overfill Protection
- Communications to the Supervisory Management System where security (access), accounting and Inventory management are handled.
- B.O.L. preparation is configurable to each customers requirements.





NOTE: THIS DRAWING IS PRELIMINARY, FOR DESIGN PURPOSES ONLY.
DESIGN AND / OR DIMENSIONS MAY CHANGE AS BUILT.

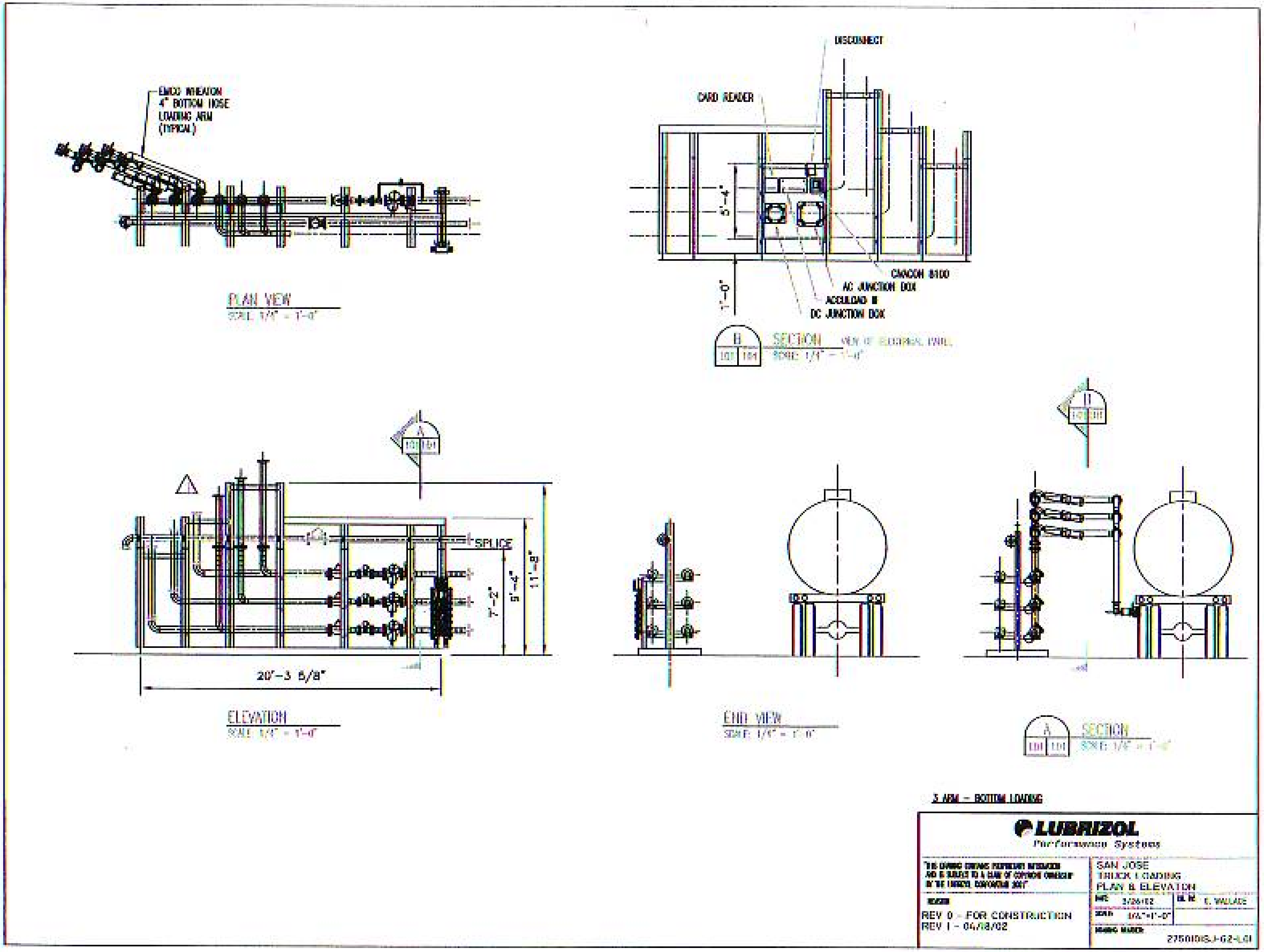
GATE CITY EQUIPMENT CO., INC.
ATLANTA, GA

LOADING SYSTEM TURBINE METER

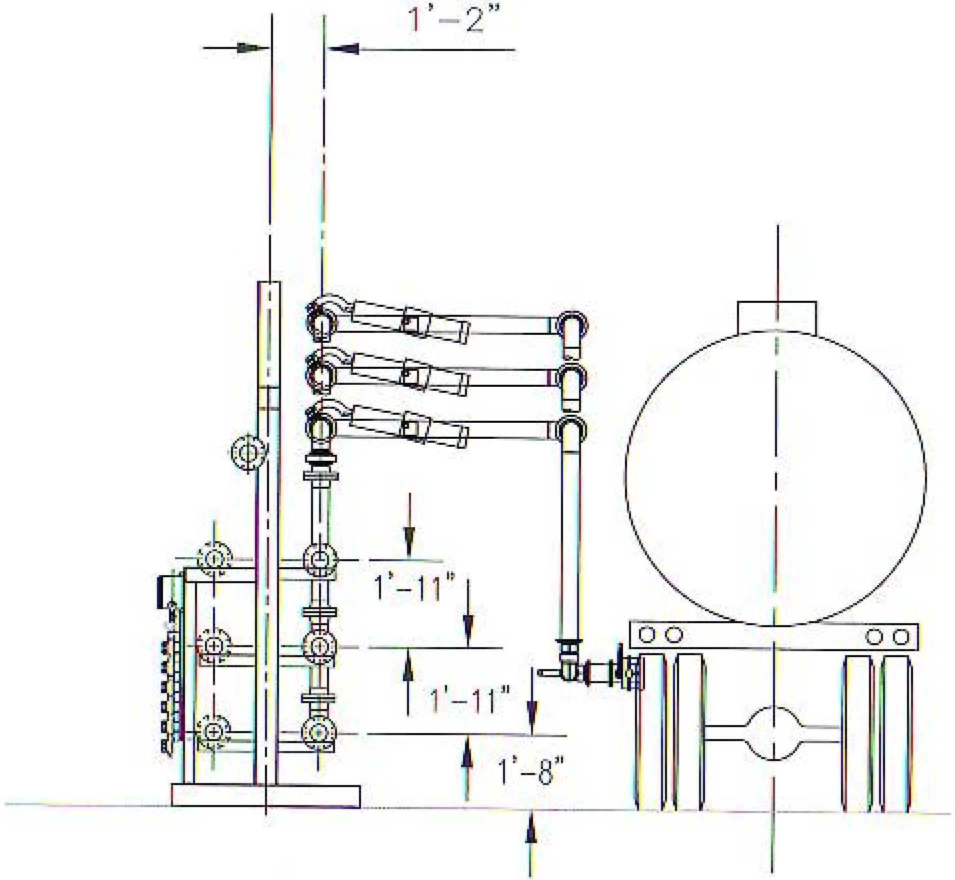
SCALE: NONE

A. THOMPSON

15-09A37.1



EMCO WHEATON 4" BOTTOM HOSE LOADING ARM (TYPICAL)
PLAN VIEW
SCALE: 1/4" = 1'-0"
DISCONNECT
CARD READER
5'-4"
1'-0"
CANACON 8100
AC JUNCTION BOX
ACCULOAD III
DC JUNCTION BOX
B
101 101
SECTION
VIEW OF ELECTRICAL PANEL
SCALE: 1/4" = 1'-0"
A
101 101
SPLICE
7'-2"
5'-4"
11'-8"
20'-3 5/8"
ELEVATION
SCALE: 1/4" = 1'-0"
B
101 101
END VIEW
SCALE: 1/4" = 1'-0"
A
101 101
SECTION
SCALE: 1/4" = 1'-0"
3 ARM - BOTTOM LOADING
LUBRIZOL
Performance Systems
SAN JOSE
TRUCK LOADING
PLAN & ELEVATION
3/26/02
E. WALLACE
1/4"=1'-0"
REV 0 - FOR CONSTRUCTION
REV 1 - 04/18/02
27501DSJ-G2-L01



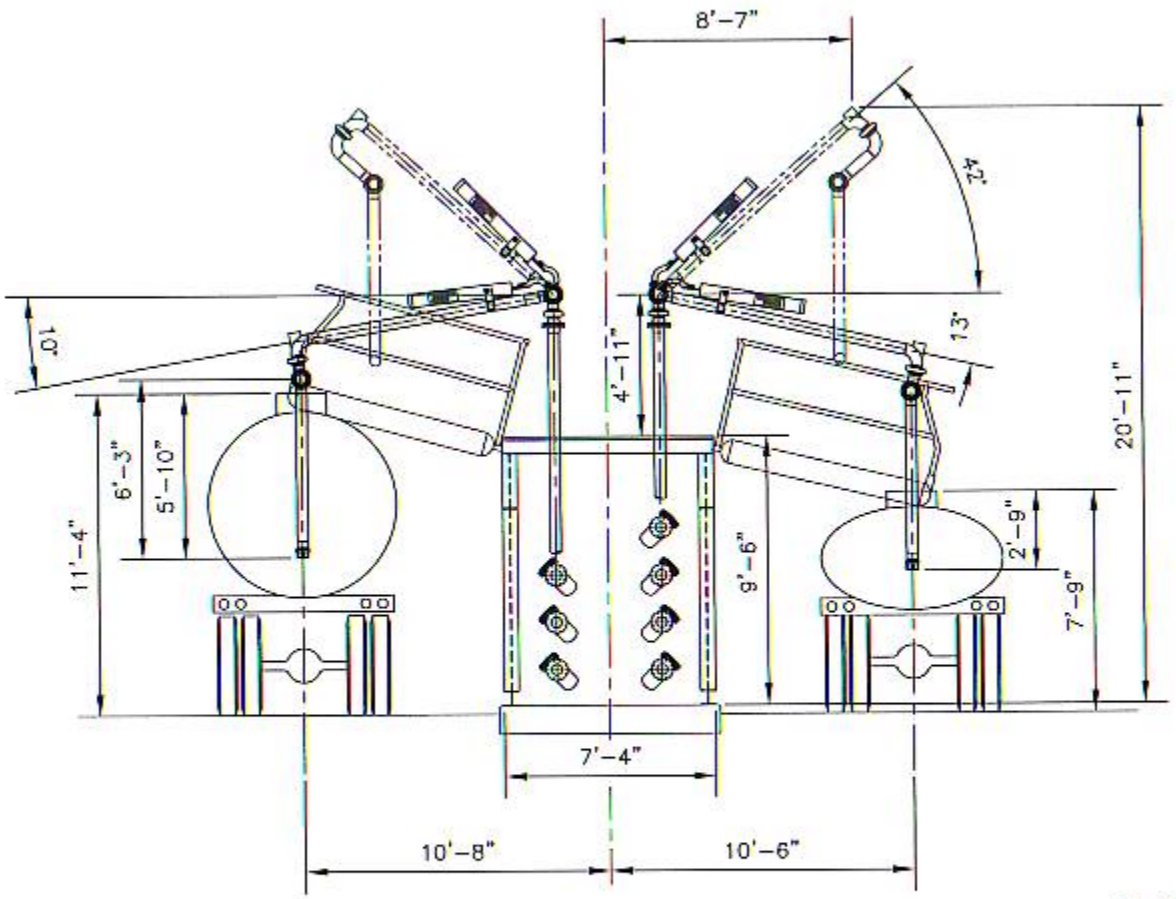
TYPICAL BOTTOM LOADING

SCALE: 1/4" = 1'-0"

LUBRIZOL
Performance Systems

TYPICAL BOTTOM LOADING

R. WALLACE



END ELEVATION
SCALE: 1/4" = 1'-0"

7 ARM – TOP LOADING

LUBRIZOL
Performance Systems

PUERTO BARRIOS
TRUCK LOADING
END VIEW

REVISION
RELEASED FOR CONSTRUCTION

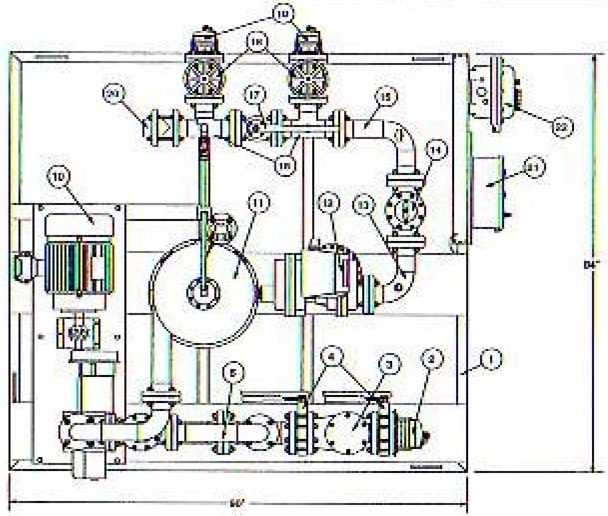
DATE 6/26/07 DR. BY G. WALLACE

SCALE 1/4"=1'-0"

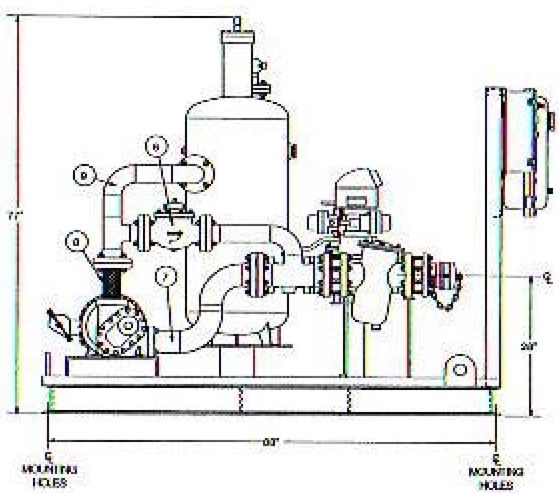
DRAWING NUMBER 27560BPB-MH-L02

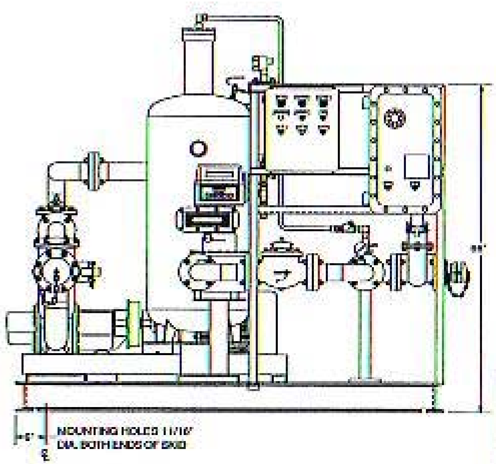
Offloading Ethanol at blending terminals skid mounted or site fabricated usually dropped to site tanks via hose.

- Air elimination is critical to accurate ethanol off-loading.
- Custody transfer meters cannot tell the difference between air or liquid.
- Small quantities air relief heads on strainers.
- Large quantities – truck off-loads, rail car off-loads, particularly multi-drop rail cars have entrained air or “rushes.”
- Air eliminator vessel with baffles and electric or float release heads get the air out.
- Sized by quantity of air, application, viscosity, vapor of the product, not by the line size or gallons being handled.
- Air is than taken from this air head release point past the meter, back into the line or back to a vapor recovery tank. Sometimes two or more heads are necessary to make this process efficient.



NO.	PART DESCRIPTION
1.	FABRICATED STEEL SKID WITH LIFTING LUGS AND DRAIN HOLES.
2.	4" CAM AND GROOVE ADAPTER WITH DUST CAP MOUNTED TO 4" 150# FLANGE.
3.	4" 150# FLANGED STRAINER WITH 40 MESH BASKET.
4.	4" ISOLATION VALVE - STEEL HIGH PERFORMANCE WAFERSPHERE.
5.	4"X2" 150# FLANGED TEE BY PASS FITTING.
6.	2" 150# HYDRAULIC BY PASS RELIEF VALVE.
7.	4"X4" 150# FLANGED PUMP INLET FITTING.
8.	4"X2" 150# FLANGED PUMP OUTLET BRAIDED HOSE.
9.	3"X2"X3" 150# FLANGED FITTING.
10.	4"X3" PUMP WITH 15 HP, 1800 RPM, 230/460 VAC MOTOR.
11.	80 GALLON STEEL TANK WITH AIR ELIMINATING SYSTEM.
12.	3" P.D. METER WITH TEMPERATURE COMPENSATOR, LNC, & TICKET PRINTER.
13.	3" 150# FLANGED ELL SECTION WITH 3/4" TEMPERATURE WELL FITTING.
14.	3" 150# TWO STAGE CONTROL VALVE.
15.	3" 150# FLANGED ELL SECTION WITH 3/4" TEMPERATURE WELL FITTING.
16.	3"X3" 150# FLANGED TEE SECTION WITH 3/4" THREAD-O-LET.
17.	2" 150# FLANGED DOUBLE BLOCK AND BLEED BALL ISOLATION VALVE.
18.	3" 150# FLANGED CAST IRON GATE VALVE.
19.	3" CAM AND GROOVE ADAPTER WITH DUST CAP MOUNTED TO 3" 150# FLANGE.
20.	3" STEEL DOUBLE DISC CHECK VALVE WITH VITON SEAT.
21	AIR & WATER ELIMINATION SYSTEM CONTROLS.
22	COMBINATION MOTOR STARTER/CIRCUIT BREAKER.





GATE CITY EQUIPMENT CO., INC.
ATLANTA, GA

[illegible]

CSX TRANSPORTATION INC.
UNLOADING SKID: NASHVILLE, TN

DATE	2/15/04	DRN.	A. THOMPSON
SCALE	1"=15"	APP. BY.	
DRAWING NUMBER	137732-0		

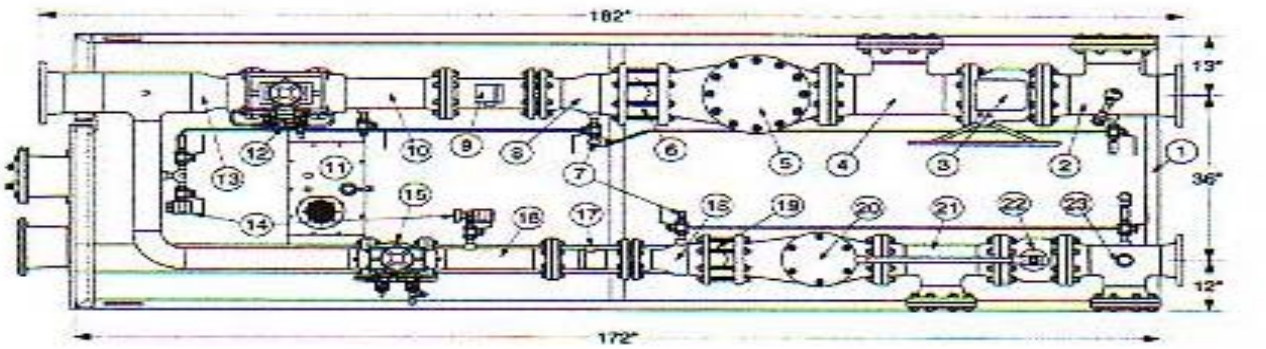
Blending Ethanol into Gasoline at Fueling Terminals

- Many options are available, the cost of each should be weighed for flexibility of the operation and the thru put.

- Options

  - Tank Farm Wild Stream Blending
  - Skid Pre-fabricated Loading Rack Blenders
  - Full Rack Modification to existing piping with Ethanol equipment and blend control thru electronic Preset either Sequential or Ratio Blends.
  - Complete Pre-fabricated Loading System delivered to site for installation.

Tank Farm Wild Stream Header Blender



Located back in the tank farm between tanks and loading rack takes fuel and ethanol blends via electronic Micro Processor to programmable recipe's.

Pro/Cons – Off Rack Blenders

Pros – Cost Effective

For this design is simplicity. You order a skid to be manufactured to meet your present rack requirements as known. It arrives; you make a single tie into your rack product line. Take the communications if desired back to your control system and you are in business.

Cons

This is a single point blender. If it has problems, you are down without a choice until it is repaired. To counter this downtime issue you could have a redundant system, but you lose your cost advantage with this solution.

This design will be to today's requirement, and would have to be reviewed to allow changes in blend or additional delivery. (growth) More product thru-put (or) more blenders / tanks.

Pre-Fabricated Loading Rack Blenders

Located at the end of the existing loading rack. Ethanol product would be brought (usually) overhead to this Ethanol Blender Header thru a strainer.

If you presently are loading unleaded, mid-grade and super across your load rack with existing recipe's, and controlled by an existing system, but you need to add a 5.7% ethanol to each arm component, you could choose this option. Micro Blenders utilize the previous meter skid design, but incorporates a flow control valve mounted with a microprocessor controller that paces through the 1.5" or 2" meter, controls flow of the ethanol blending into the product load arm. This unit would be wired either from the pulse output of the control preset, or directly to the product delivery meter. The solution is simple and could be communicated via RS485 to get verification of the ethanol and product volume delivery with alarm monitoring.

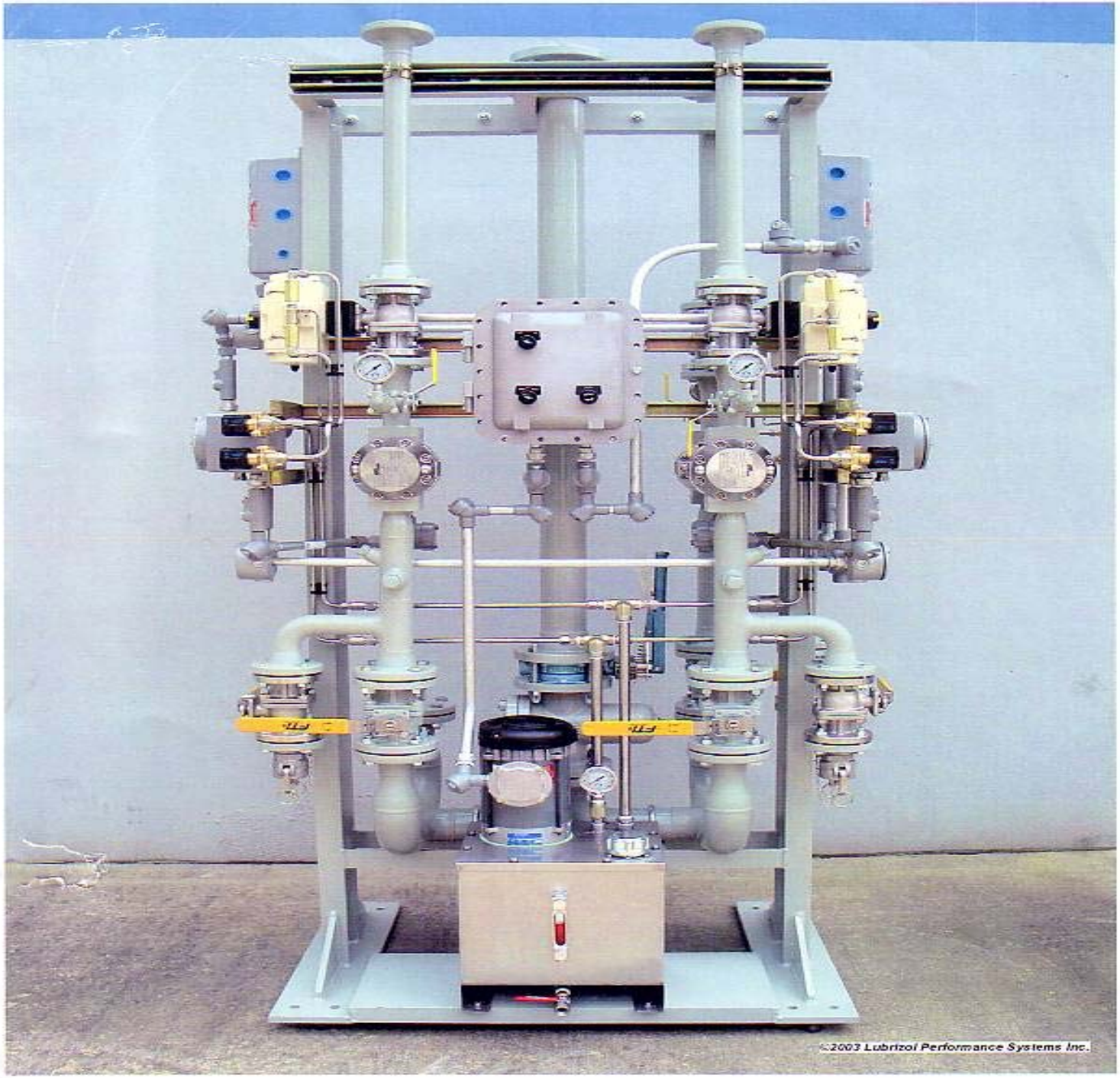
This is very flexible option. Some disruption would be necessary to bring over the ethanol product to the blender skid header, but a lane-by-lane schedule could be accommodated to a very busy terminal.

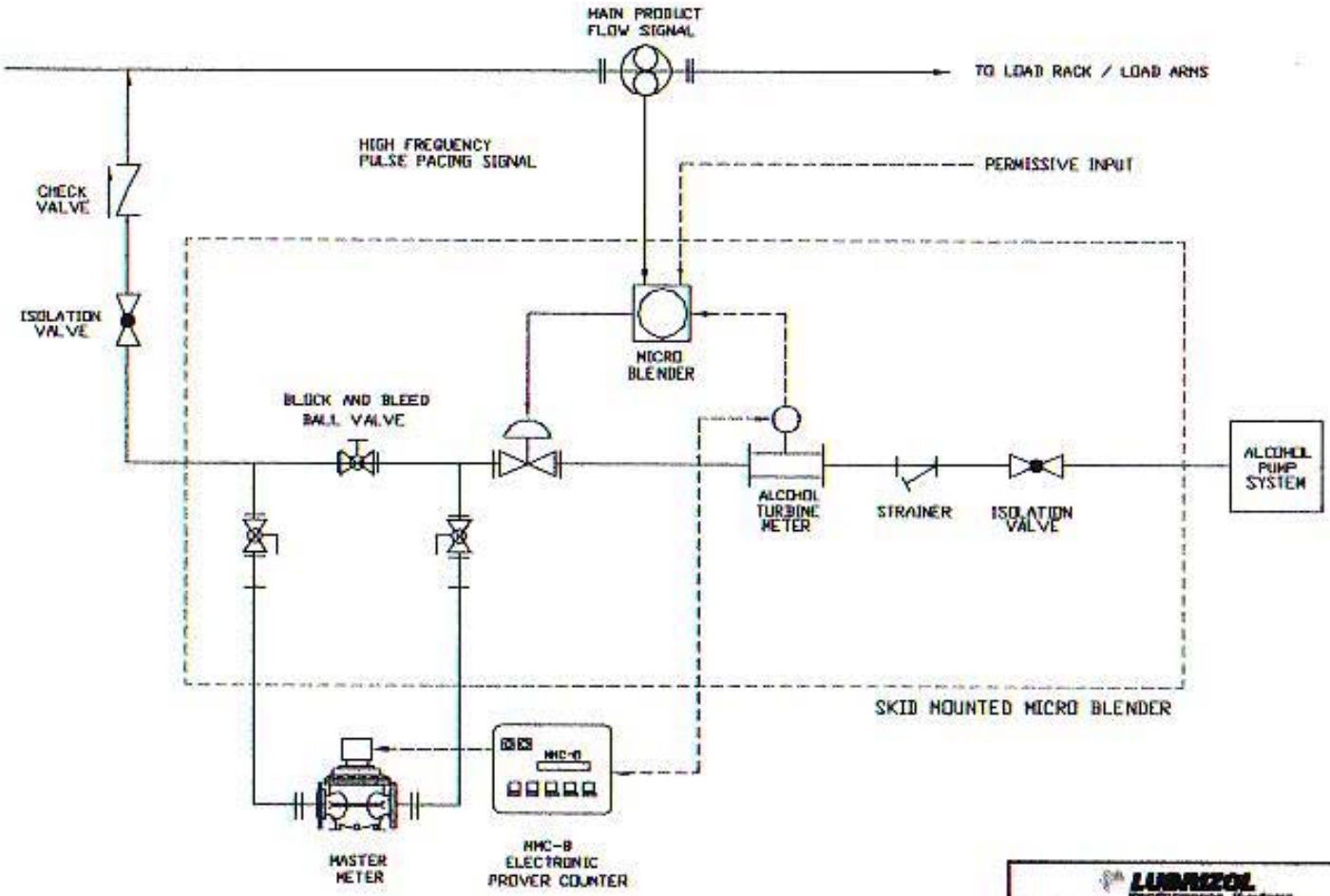
Pros – Very Cost Effective

Stand Alone Design – If you lose any one component, you lose only that arm. Flexibility – you only do what you can by lane or by arm tying in at best time available. No reprogramming to change existing recipe's or Loading practices.

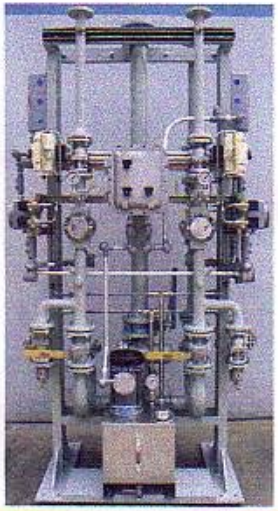
Cons

Do you have the room for the equipment on your rack? Will separating the system between blended and regular meet your overall accounting desires? This is not as flexible as a total all product blendable system.


©2003 Lubrizol Performance Systems Inc.


MAIN PRODUCT
FLOW SIGNAL
TO LOAD RACK / LOAD ARMS
HIGH FREQUENCY
PULSE PACING SIGNAL
PERMISSIVE INPUT
CHECK
VALVE
ISOLATION
VALVE
MICRO
BLENDER
BLOCK AND BLEED
BALL VALVE
ALCOHOL
TURBINE
METER
STRAINER
ISOLATION
VALVE
ALCOHOL
PUMP
SYSTEM
SKID MOUNTED MICRO BLENDER
MMC-8
MASTER
METER
MMC-8
ELECTRONIC
PROVER COUNTER
LUBRIZOL
Performance Systems
BLOCK DIAGRAM
SKID MTG. MICRO BLENDER
06/25/02
BLOCK
MDNC

LUBRIZOL
Performance Systems



The Three Stream Vertical Ethanol Blender is an intelligent Blend Controller which makes use of the latest advancements in microprocessor technology to bring unparalleled accuracy to blending applications.

It can be configured from 2 to 4 streams depending on the application.

Three Stream Vertical Ethanol Blender

Reducing the Burden of Ownership

The Vertical Ethanol Blender utilizes 3 product streams, the monitored stream is referred to as the Wild Stream, and the controlled stream is referred to as the Blend Stream. The Micro-Blend controller monitors the Wild Stream and controls the Blend Stream to the programmed blend ratio. The Blender is designed to be cost effective and simple to operate, yet provide control accuracy previously only found in expensive and complicated systems.

Features

- Blend Stream product factored pulse output
- Wild Stream and Blend Stream product totals
- User-definable alarm conditions
- Smith (Type I), Brooks (Type II) and Modbus (Type IV) Protocol
- Infrared Hand-Held Controller
- EIA 485 (2-wire) communications at 1200/2400/9600/19,2000 baud
- Backlit LCD (Liquid Crystal Display) with 2 lines by 14 characters
- Internal watchdog low power protection
- 4 levels of password security (8 users definable)
- Built-in proving preset

Applications

- Oxygenate Blending
- Analytical Blending
- 5 GPM - 100 GPM

LUBRIZOL
Performance Systems

Electrical Inputs

- AC Instrument Power: 120/240 VAC +/- 15%, 48 to 63Hz.,1.0A maximum or 240 VAC +/- 15%, 48 to 63 Hz
- Current Consumption: <50 mA. @120 VAC/<25 mA @ 240 VAC
- AC circuitry is fuse protected (Does not include inputs or outputs)
- Surge current 10A maximum for less than 0.1 seconds
- One (1) Optically isolated, AC solid state triac input (permissive input)
- Load voltage range: 90 to 280 VAC , 48 to 63 Hz.
- Steady state load current range: 0.05A (rms) minimum to 5A (rms) maximum into an inductive load
- Leakage Current @ Maximum Current rating: 100 microamps maximum @ 240 VAC
- Duty Cycle: 40/60 to 60/40 (on/off)

Pulse Input

(Pulses per Gallon / Liter / etc.)

- Type: DC
  Maximum Pulse Rate: 5 KHz
- Minimum 10 pulses per unit

Electrical Outputs

- Three (3) Optically isolated, AC solid state triac outputs (2 used for digital valve control - 1 for alarm output)
- Load voltage range: 90 to 280 VAC , 48 to 63 Hz.
- Steady state load current range: 0.05A (rms) minimum to 5A (rms) maximum into an inductive load
- Leakage Current @ Maximum Current rating: 100 microamps maximum @ 240 VAC
- Duty Cycle: 40/60 to 60/40 (on/off)

Pulse Output

- Open Collector Transistor
- 1, 1/10th, 1/100th, 1/1000th unit volume, or unfactored pulse output available

Display

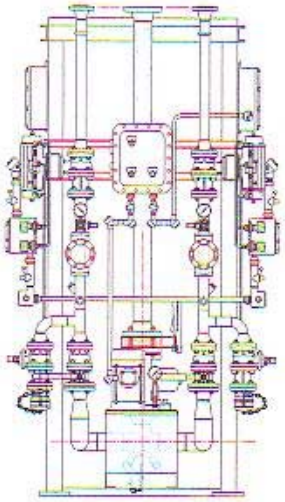
- Module Format: 2 Line by 14 position display
- Type: Liquid Crystal Display Backlit
- Character Format: 5 by 7 dot matrix type

Environmental

- Ambient Operating Range: -40°F to 150°F (Display may appear slow at temperatures below 0°F)
- Humidity: 5 to 95% without condensation

Communications

- General Configuration: Multidrop Network. 32 Micro-Blend™ Systems may be connected to the same host
- Data Rates: 1200/2400/9600/19,200 Baud rate supported
- Data Format: 8 data bits/No parity/1 stop bit
- Type: Interfaceable with EIA-485 (2-wire) data communication standard



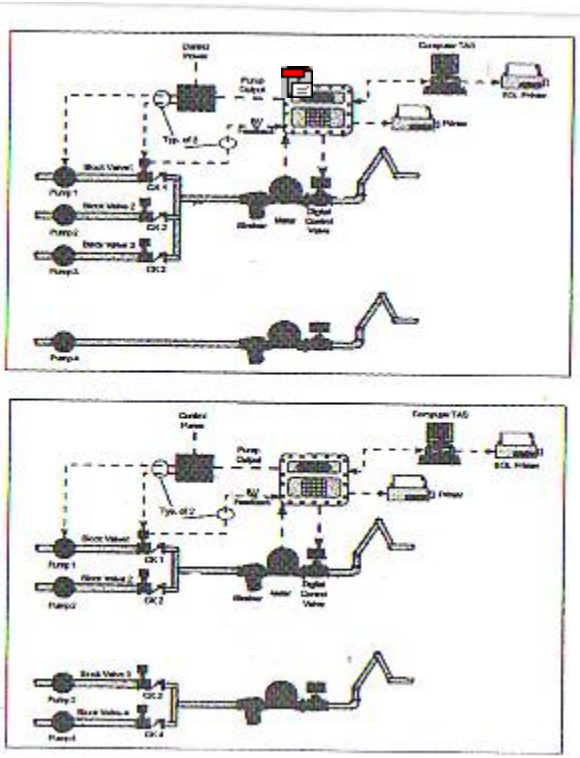
ETHANOL BLENDER
W/ 2" SS P.D. FLOW METER
& 2" HYDRAULIC V-PORT BALL CONTROL VALVE
HYDRAULICALLY ACTUATED

- **Lubrizol Performance Systems Inc.**
  2000 Northfield Court, Roswell, GA 30076 USA
  Ph: (770) 475-1900 Fax: (770) 475-1717
- **Lubrizol Performance Systems Ltd.**
  6 Pennant Park, Standard Way, Fareham, UK PO16 8XU
  Tel +44 1329 825 823 Fax +44 1329 825 824

On Load Rack All Or Some Product Blending Either Sequential / Ratio

Here you have to make a decision, and it is an important one. How flexible do you have to be to supply your customers? How important is your flexibility as compared to the cost, how much down time (loss of rack delivery) can your facility accept?

First, the industry's most popular design is the use of the Electronic Preset Controllers because of the flexibility, but which one ratio or sequential?



Ratio Blending

Pros

- Multiple Meters
  - Low, High Octane's, Ethanol

Recipe driven any combination / blended simultaneously. Monitoring pump function, valve control by meter pulse feed back.

At any point during delivery you are on product specification.

Cons

- Cost
  - Meters, valve, pulse output per product necessary.
  - Down time while under piping / electrical construction.
  - Do you need this much flexibility to simply add Ethanol to Gasoline.

Sequential Blending

Utilize one meter pipe all products to be blended to that single meter.
Starting with the lowest octane (ethanol) than finishing with the highest octane product insuring the arm is packed to the highest octane level for the next load security of blend.

Example:

- A driver asks for 1000 gallons of mid-grade gasoline. The preset recipe would turn on the lowest octane product pump, open the product valve, select and apply that product K-factor, and deliver with low flow start into hi flow, the proper predetermined volume to obtain that 1000 gallon blend. This same process would repeat using the ethanol, and finally the highest, octane product. Remember, this would be customer specific recipe, including the additive control.

Pros

- One big one. Less expensive to install – you need less equipment.

Cons

- Time – you are in and out of the low flow start/stop on each product, except the small quantity of ethanol. This can pose a problem when you are using turbine flow meters and marginal pumps not maintaining an even pressure profile to the blend meter. Thus, causing you to be below the accurate linear curve of low flow start and more often introducing possible error to your blend.
- If your customer driver has a retained product in his tank, you will have no choice but pump-off to Transmix when dome out without getting to the end of the proper product delivery. This would also be necessary, if during the blend process you lose a pump or my favorite, the driver enters wrong volume requested and doesn't catch it. He than stops the loading and tries to correct his error, again usually causing a "pump off" situation.
- The fact with all of these scenarios is that they are costly to operations. It was a cheaper installed cost, but a higher operating cost overall, particularly when you consider the cycling of the pumps, motors, valves, and control valve solenoids, causing additional maintenance and in the case of the solenoids, an "overfill" risk.
- Another consideration is the quality of a layered blend. You rely on a rough road truck mixing or the station drop to insure a good blend of product, not necessarily the quality inspectors' idea of a good option.

Special Equipment for Handling Ethanol

- Measurement
  - Flow Meters
- Valves
  - Control
  - Check
- Hoses, Swivels, Loading Arms, Couplers, Vapor
- Detonation Flame Arrestors
- Tank Level Options
  - Radar
  - Wireless

Measurement

Brodie P.D.’s & Turbines

Lubrizol – P.D.’s

Micro Motion – Mass

Liquid Controls – P.D.’s

Smith – Turbines

Krohne – Ultrasonic

LUBRIZOL
Performance Systems

GC15CSRS

1 1/2" Stainless Steel Oval Gear Meter

Lubrizol Performance Systems Meters' versatile STEALTH Series is available in a variety of configurations including mechanical registration, electronic registration or non-factored pulse output flow sensors.

With only two moving parts and exceptional pressure loss characteristics, STEALTH represents the ideal platform for year 2000 metering systems.

Alcohol & Refined Fuel Meters

Reducing the Burden of Ownership

Registration Options

- Mechanical register: 4, 5, or 6 digit
- Mechanical register/printer, register/preset, or register/preset/printer combination
- Battery-powered electronic totalizer or register
- Electronic AC batch controllers, flow computers, and temperature compensation
- NEMA 4X & NEMA 7/4 enclosures

Accessories

- Inlet strainer for meter protection
- Air eliminator on inlet strainer
- Air check valve with air eliminator
- Mechanical preset (shut-off) valve
- Electric or pneumatic preset valve
- Pulse output, analog signal & serial port
- Pulse Isolator/Amplifier/Splitter
- Pump control signal

Note: Recommended protection

Inlet strainer, depending upon viscosity, with 20, 40, or 80 mesh basket.

LUBRIZOL
Performance Systems

Specifications

Flow Rate

- 3 - 60 GPM, viscosities to 300 CST
- 12 - 230 LPM, viscosities to 300 CST

Maximum Intermittent Flow Rate

- 75 GPM
- 284 LPM

Pressure

- 150 PSI @ 100°F (10 Bar @ 40°C)
- 400 PSI @ 100°F (28 Bar @ 40°C) Meter only

Temperature

- 300oF (149°C) RSFS only
- 212oF (100°C) mechanical registers
- 185oF (85°C) HEFS only
- Other limits may apply to electronic devices

Viscosity

- Full nominal flow rate to 300 CST
- Up to 350,000 CST with special gears

Connections

- 1 1/2" NPT or BSP
- Optional: 1 1/2" ANSI flange adaptors

Materials

- Case: 303 Stainless Steel
- Oval gears: Ryton (PPS)
- Posts: 17-4 PH Stainless Steel
- Seals: Teflon

Industrial Performance

Linearity

- +/- 0.25% @ 1 CST

Repeatability

- better that +/- 0.05%

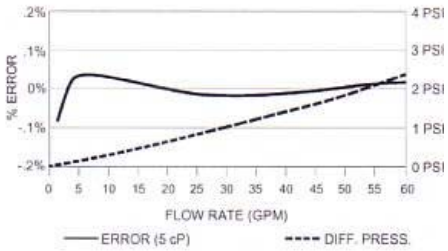
Resolution

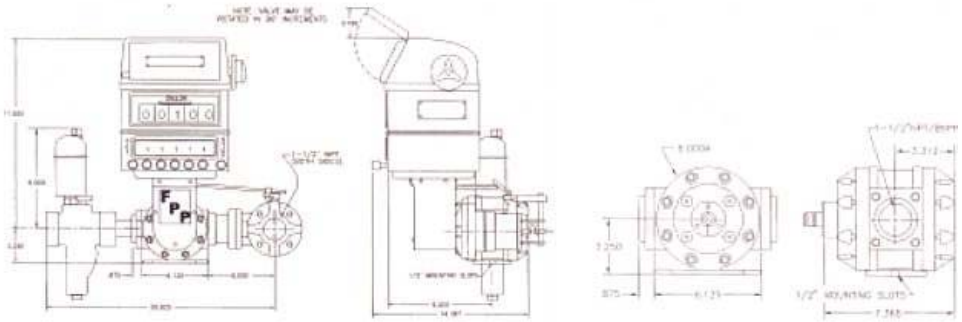
- Flow Sensor: 108 PPG
- Optional: 216 PPG

Calibration

- Mechanical: 1/10 gallon, lbs., liter & kg
- Electronic: Any unit of mass or volume

Delta P & Accuracy Curves





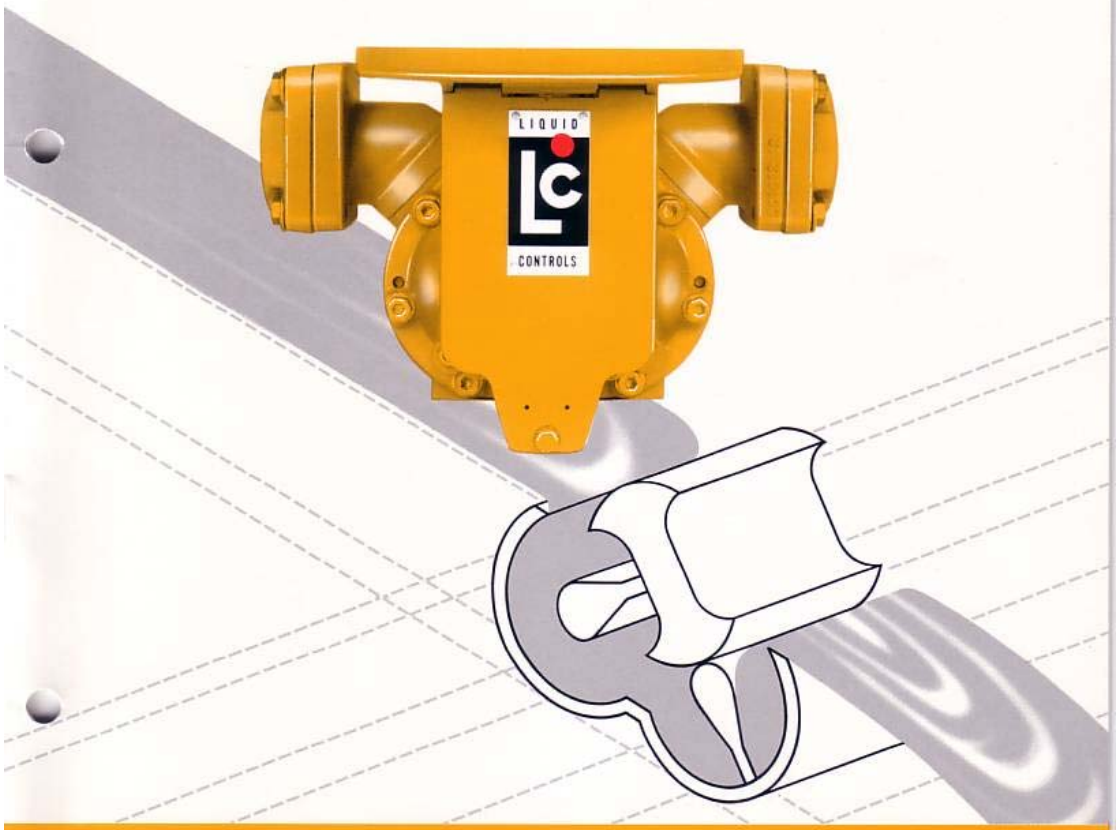
Warranty:

Lubrizol Performance Systems, Inc. warrants its products to be free from defects in material and workmanship for a period of one (1) year fro of shipment. Lubrizol Performance Systems, at its option, will repair, replace, or issue credit equal to the amount invoiced if the product is foun defective within the warranty time; FOB Factory. After receiving a RMA#, products assumed to be defective should be returned freight p Surface freight charges to send the replacement unit to the customer will be Lubrizol Performance Systems' responsibility. Expedited air freig courier charges will be billed to the customer. Lubrizol Performance Systems shall not be liable for any labor, or for direct, indirect, spe consequential damages. Warranty shall not apply to any defect or failure in products caused by abuse, misuse, negligence, or alteration of p Merchandise sold by Lubrizol Performance Systems but manufactured by others will carry the manufacturer's warranty.

METERS AND ACCESSORIES

LIQUID CONTROLS

Product Overview



METER MODELS

Listed in order of Maximum Nominal Flow Rates. Consult LC Publication #195 for product application and material class recommendations.
Maximum Non-Shock Working Pressure (PSI) ratings are based on metering products at temperatures below 160°F (71°C).

Maximum Nominal Flow Rate	Standard Flange Size*	Primary Material	Material Classes	150 PSI 10.5 BAR 1034 kPa	275 PSI 19 BAR 1896 kPa	300 PSI 21 BAR 2068 kPa	350 PSI 25 BAR 2413 kPa	720 PSI 50 BAR 4964 kPa	1,440 PSI 100 BAR 9927 kPa
30 GPM (113 L/min.)	1 ½" NPT	Aluminum	10				MA-4+		
60 GPM (227 L/min.)	1 ½"	Aluminum	1,2,3,4,10,14,16 & 30	M-5	M-5**		MA-5+		
	2" Optional	Stainless Steel	8	M-5					
100 GPM (380 L/min.)	2"	Aluminum	1,2,3,4,10,14,15 & 16	M-7	M-7**		MA-7+		
	1 ½" Optional	Stainless Steel	8	M-7					
		Cast Iron	7,27 & 37	M-7	M-7**				
	2"	Brass	20	M-7	M-7**				
	2"	Steel	1,2,7,10,14,16 & 37	MS-7	MSAA-7	MSA-7		MSB-7	MSC-7
150 GPM (550 L/min.)	2"	Aluminum	1 & 2	M-10	M-10**				
200 GPM (757 L/min.)	3"	Aluminum	1,2,3,4,10,14,15 & 16	M-15	M-15**		MA-15+		
	3"	Steel	1,2,10,14 & 16	MS-15	MSAA-15	MSA-15		MSB-15	MSC-15
	3"	Stainless Steel	8		MSAA-15				
300 GPM (1,136 L/min.)	3"	Aluminum	2	M-25	M-25**				
350 GPM (1,325 L/min.)	4"								
	3" Optional	Aluminum	1,2,3,4,14,15 & 16	M-30					
	3"	Cast Iron	7,27,37 & 47	M-30					
	3"	Steel	1,2,10,14 & 16	MS-30	MSAA-30	MSA-30		MSB-30	MSC-30
	3"	Stainless Steel	8		MSAA-30				
450 GPM (1,700 L/min.)	4"	Aluminum	1 & 2	M-40					
	3"	Steel	1 & 2	MS-40					
600 GPM (2,271 L/min.)	4"								
	6" Optional	Aluminum	1,2,3,14 & 15	M-60	M-60**				
700 GPM (2,650 L/min.)	4"	Steel	1,2,10 & 14	MS-75	MSAA-75	MSA-75		MSB-75	MSC-75
800 GPM (3,000 L/min.)	6"								
	4" Optional	Aluminum	2	M-80	M-80**				
1,000 GPM (3,785 L/min.)	6"	Steel	1,2,10 & 14	MS-120	MSAA-120	MSA-120		MSB-120	MSC-120
	6"	Stainless Steel	8		MSAA-120				

*FLANGES: All standard M-Series Meters are supplied with choice of threaded NPT and BSPT companion flanges...or slip-on welding companion flanges. MA-Series Meters are supplied standard with threaded NPT companion flanges.
**275 PSI working pressure available for meter only.
All MS-Series steel case Meters are supplied standard with ANSI flanged connections. DIN Optional. Reducing flanges are available for all steel case Meters.
+ MA-Series Meters are all UL Listed for LPG.

INDUSTRIES SERVED

Adhesives
Agriculture
Asphalt
Aviation Fueling
Animal Feeds
Beverage
Lube Oils
Cosmetics
Chemical Processing
Concrete Add Mixtures
Dairy
Liquid Fertilizers
Food Processing
Fuel Oil Delivery
General Industrial
Hydrocarbon Processing
Liquefied Gases
Paint and Varnish
Petroleum Marketing
Petroleum Production
Pharmaceutical
Printing Ink
Pulp & Paper
Refining
Textile

CUSTOMERS SERVED

(List derived from Fortune Magazine. Many other valued customers, while not included by the magazine, are of equal importance to LC)

General Motors
Exxon
Mobil
Ford Motor
International Business Machines
Texaco
Chevron
E.I. du Pont de Nemours
General Electric
Amoco
Atlantic Richfield
Chrysler
Shell Oil
U.S. Steel
United Technologies
Phillips Petroleum
Tenneco
Occidental Petroleum
Sun
Proctor & Gamble
R.J. Reynolds/Nabisco
Standard Oil

ITT
Beatrice
Phillip Morris
Dow Chemical
McDonnell Douglas
Rockwell International
Unocal
Westinghouse Electric
Eastman Kodak
Kimberly-Clark
Goodyear Tire & Rubber
Lockheed
Allied-Signal
General Foods
Union Carbide
Xerox
PepsiCo.
General Dynamics
LTV
Coca-Cola
Sara Lee
Minnesota Mining & Manufacturing

Ashland Oil
Amerada Hess
W.R. Grace
Coastal
Anheuser-Busch
Caterpillar Tractor
Monsanto
Georgia Pacific
Honeywell
Johnson & Johnson
Ralston Purina
Champion International
Sperry
General Mills
ConAgra
Armco
Weyerhauser
Aluminum Co. of America
Bethlehem Steel
Northrop
Burroughs
Colgate-Palmolive
Texas Instruments

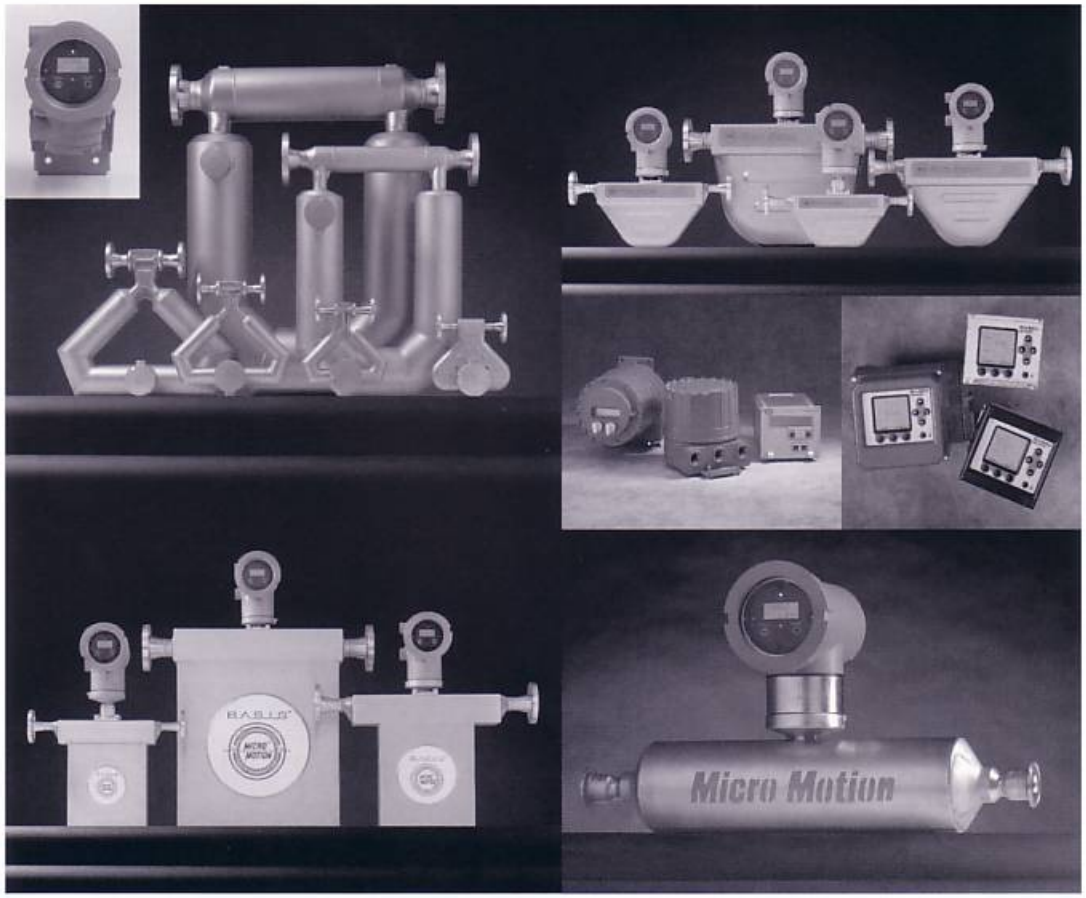
Archer Daniels Midland
Borden
American Home Products
Pillsbury
Litton Industries
International Paper
Bristol Myers Squibb
Martin Marietta
Farmland Industries
Union Camp
Deere
H.J. Heinz
Pfizer
Campbell Soup
Borg-Warner
Firestone Tire & Rubber
International Harvester
Boise Cascade
Eaton
Owens-Illinois
American Cyanamid
Merck
Quaker Oats

Whirlpool
Reynolds Metals
American Standard
Abbott Laboratories
Kerr-McGee
Owens-Corning Fiberglas
Eli Lilly
FMC
SmithKline Beecham
Teledyne
B.F. Goodrich
Manville
Warner-Lambert
Inland Steel
Olin
Crown Zellerbach
Cooper Industries
Scott Paper
Grumman
Diamond Shamrock
Avon Products
Staley Continental
Kellogg

Swift Independent
American Can
Burlington Industries
Mead
Kaiser Aluminum & Chemical
Ingersoll-Rand
Interco
Hercules
BASF
Fruehauf
Penn Central
USG
James River Corp. of Virginia
Revlon
American Petrofina
Gillette
Baxter Healthcare
Land O'Lakes
Engelhard
Jim Walter
Pennzoil

Cabot
Murphy Oil
Sherwin-Williams
Dresser Industries
Uniroyal
Upjohn
Lever Brothers
Mack Trucks
Rohm & Haas
CPC International
R.R. Donnelley & Sons
Hershey Foods
PPG Industries
Morton Thiokol
Mapco
Schering-Plough
Libbey-Owens-Ford

Specifications Summary



Micro Motion

All Micro Motion sensors share these features:

- ***No*** moving parts
- ***No*** special mounting or flow conditioning
- ***No*** straight pipe run requirements
- ***Direct*** measurement of mass flow rate
- Available with **MVD™ Technology**

ELITE®

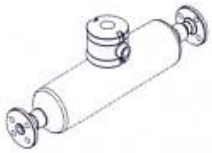
- Highest performance and rangeability
- Unsurpassed immunity to field effects such as pressure, temperature, and vibration
- Secondary pressure containment is standard

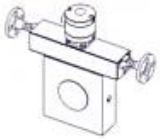
Models: CMF010, CMF010P, CMF025, CMF050, CMF100, CMF200, CMF300, CMF300A, CMF400

T-Series

- Single-straight-tube design
- Most compact
- Self-draining
- Approved for use in 3A and EHEDG sanitary applications
- Clean or sterilize in place (CIP/SIP)
- Secondary pressure containment to 50 bar is standard
- Optional integrally mounted electronics and display

Models: T025, T050, T075, T100, T150





F-Series

- More accurate and often more cost-effective than volumetric technologies
- Optional integrally mounted electronics and local display

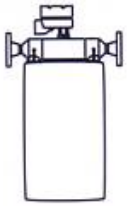
Models: F025, F050, F100, F200

R-Series

- General purpose Coriolis flowmeter priced competitively with traditional flowmetering technologies
- Integrally mounted sensor and transmitter, with optional local display

Models: R025, R050, R100, R200

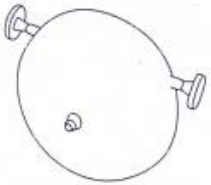
Model D



- Wide range of sizes, including the D600, which is suitable for 6-inch (150 mm) line sizes
- Available with Tantalum and Tefzel® wetted parts
- High-pressure (DH) models

Models: D25, DH25, DH38, D40, D65, D100, DH100, D150, DH150, D300, DH300, D600

Model DT



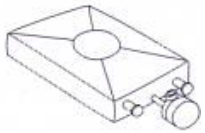
- Operating temperatures up to 800˚F (426˚C)
- Sizes from ½ to 1-½ inch (15 to 40 mm)

Models: DT65, DT100, DT150

CNG Sensor

- Designed to meet Compressed Natural Gas industry standards
- For use in automobile or light and heavy duty vehicle dispenser design
- NTEP approved
- See Product Data Sheet for more details

Model DL



- Continuous-single-tube design
- Approved for use in 3A sanitary applications
- Self draining

Models: DL65, DL100, DL200

FMC EnergySystems

FMC Measurement Solutions

1" to 4" Guardsman™ LB, LJ and LSJ Series

Specifications

Issue/Rev. 1.3 (8/03) Bulletin SS02003

*The **Smith Guardsman LB, LJ and LSJ Series Turbine Meters** are rimless-type rotor meters which utilize an upstream stator to support the rotor. They are intended for use at loading racks to provide highly accurate measurement required for custody transfer of petroleum liquids.*

Features

- **Stainless steel measuring chamber and internals.**
- **Locking stator** to prevent wear and improve performance.
- **Horizontal or vertical installation.**
- **Tungsten carbide** journal bearings (LJ and LSJ versions) for continuous duty service and extended life on petroleum products.
- **PA-6 Preamplifier.**
- **Integral strate plate flow conditioner** (3" and 4" only).

Options

- **Multiple pickup coils** for use when pulse security is required.
- **AccuLERT ID-2000 Smart Preamplifier** for real-time diagnostics of meter performance.

3" LSJ Turbine Meter with Integral Strate Plate

Operating Specifications

Flow Range

Meter Size	Model	Units[2]	Normal[1] Flow Range Min.	Normal[1] Flow Range Max.	K-Factor (Pulses/Units Volume) Nominal
1"	LB[3]	USGPM	8	80	950
		L/min	30	300	250
1.5"	LJ & LB[3]	USGPM	13	130	240
		L/min	50	500	63.4
2"	LJ & LB[3]	USGPM	25	250	125
		L/min	95	950	33
3"	LSJ-H	USGPM	70	700	52.7
		L/min	265	2,650	13.9
3"	LSJ-V	USGPM	70	700	60
		L/min	265	2,650	15.8
4"	LSJ-H or V	USGPM	120	1,200	25
		L/min	450	4,500	6.6

Linearity

	Normal Flow Range 1"	Normal Flow Range 1.5" and 2"	Normal Flow Range 3" and 4
Standard	+/-0.25%	+/-0.25%	+/-0.15%
Premium	N/A	+/-0.15%	C/F

C/F = Consult factory.

Repeatability

±0.02% over the entire normal range.

End Connections

Class 150, 300 ANSI B16.5 125–250 AARH finish raised face (RF) flanges.

Maximum Working Pressure[4] - PSI (kPa)

ANSI	
150	285 (1,965) Carbon Steel
300[5]	740 (5,102) Carbon Steel

1 *Based on 0.8 sp. gr., 1.5 mPa·s (1.5 cP) liquid.*
2 *Metric units are nominal and may not convert precisely.*
3 *Model LB (Ball Bearing) can be installed hortzontally or vertically. Model LB meters should not be used for LPG Service or on products with a viscosity of less than 0.5 cP.*
4 *Maximum working pressures are for temperatures of -20°F to 100°F (-28°C to 38°C). Consult factory for maximum working pressures at other temperatures.*
5 *Not available with 1" Guardsman LB series meters.*

KROHNE

 7.02390.71.00

GR/PRINTO

UFM 3030

Universal 3-beam in-line ultrasonic flowmeter for liquids

UFM 3030
Universal 3-beam in-line ultrasonic flowmeter for liquids

Ultrasonic flowmeters
KROHNE has over 25 years experience in ultrasonic flow metering. Since 1980 over 30,000 KROHNE ultrasonic flowmeters have been installed in the field with reliable and trouble-free operation.

With their high level of performance, unique properties and wide application range, ultrasonic flowmeters are gaining a leading position in the global flowmeter market. The benefits provided by ultrasonic flow meters are rapidly making them indispensable solutions for industrial processes.

UFM 3030 offers all advantages of ultrasonic flowmeters. Flow measurement is independent of conductivity, viscosity, temperature, density and pressure. The unobstructed flow sensor, with smooth surface finish, inhibits any material build up. This, combined with no moving parts to wear out, provides for many years of maintenance-free service.

Universal use
UFM 3030 has a very wide application range. In industrial process applications, both acids and caustic solutions can be measured, ranging from sulfuric acid to caustic soda. Also, inorganic substances from molten sulfur to chlorine and organic substances including liquefied gasses do not cause any problems for UFM 3030.
In the oil and gas industry the applications range from heavy crude oils to bitumen and liquefied petroleum gasses (LPG's).
In the water markets UFM 3030 can be used for measuring drinking water as well as for cooling water and demineralized water.

It is KROHNE's policy to test every flowmeter that leaves our factory by means of wet calibration to guarantee the highest possible accuracy and quality standards. Therefore KROHNE owns accredited calibration rigs that comply with the most stringent demands (according to **IEC-ISO 17025**).

CE Ex

Experience a new dimension in ultrasonic technology

A new dimension in:

- Performance
- Installation
- Operational and maintenance costs
- Price

The third beam adds a new dimension!

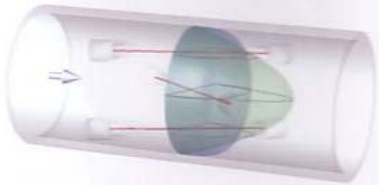
The three measuring beams of UFM 3030 generate a 3-dimensional cross-section of the medium's velocity distribution, or flow profile, through the measuring tube. These measuring beams are positioned such that measurement is effectively independent of the flow profile.

Major performance improvements have been achieved by applying innovative electronics in combination with Digital Signal Processing (DSP). This results in stable and reliable measurements.
The meter is therefore more accurate and less sensitive to changes in the flow profile, solids or entrained air. UFM 3030 is a universal meter in a very broad range of applications.

A new feature of the UFM 3030 is the possibility to control batching operations, directly from UFM 3030. Optionally, pressure and temperature inputs can be accommodated for the calculation of standardized volumetric flow or mass flow (according to API 2540 or customer specifics).

Naturally, a complete offering of communication protocols and approvals for hazardous areas makes it possible to integrate the meter into existing systems.

Flow profile



The third measuring beam allows UFM 3030 to take conditions from laminar to turbulent flow into consideration.

Step into the new dimension!

UFM 3030 exceeds your expectations in...

...Performance

UFM 3030 has a very wide application range. Three measuring beams combined with patented sensors, dedicated electronics and innovative digital signal processing techniques provide reliable, stable measurements, even under difficult process conditions. As a result, flowmeter drift and, therefore, process re-tuning has become an annoyance of the past.

...Installation

UFM 3030 is a light-weight, compact meter that is easy to install and operate. Additional arrangements such as filters, flow strainers, supports, grounding or isolation against vibrations are not necessary. Since the meter is maintenance-free, even installation in difficult to access locations is possible.

...Operational and maintenance costs

UFM 3030 has no intruding or moving parts. There is no additional pressure loss or wear and tear. Thus the meter is maintenance-free and far more energy efficient.

...Price

UFM 3030 is very attractively priced. The total costs of a measuring installation with UFM 3030 are considerably lower than those of a comparable installation of a coriolis mass or a vortex flowmeter. Moreover, one universal meter for all your applications keeps your engineering and inventory costs to a minimum.

How does UFM 3030 operate?

UFM 3030 operates like all KROHNE ultrasonic flowmeters, by the transit-time differential method. This measuring principle is based on a simple physical principle. Imagine two canoes crossing a river diagonally, one with the flow and one against the flow. Naturally, the canoe that is travelling with the flow will reach the opposite side sooner than the canoe that is travelling upstream. Acoustic signals behave in a comparable way.

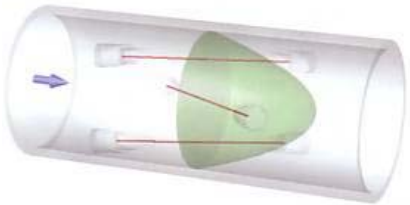
By means of 3 pairs of patented ultrasonic transducers, the transit times of acoustic signals that travel upstream and downstream are measured.

The difference in transit time is proportional to the mean flow velocity and is converted into an output signal and display of volumetric flow rate and total.

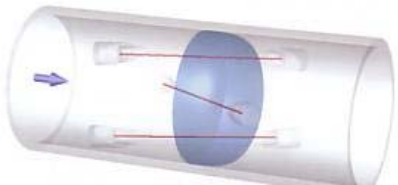
The measuring beams in a UFM 3030 make a three-dimensional cross section of the velocity distribution or flow profile of the medium flowing through the measuring tube. These measuring lines are positioned so that the influence by flow profile (laminar or turbulent) is reduced greatly. Combined with the use of the latest digital processing techniques, the results are stable and reliable flow measurements.

Day in, day out. Year in, year out. There is no drift in measurements, and repeatable process control is achieved.

Laminar flow



Turbulent flow



UFM 3030 Specifications

Versions

The UFS 3000 ultrasonic flow sensor is combined with the UFC 030 ultrasonic flow converter to make a complete flowmeter, the UFM 3030 ultrasonic flowmeter, either in separate or compact version. Both the sensor and the converter are approved for use in hazardous areas.

Compact Version
UFM 3030 K

UFC 030 K ultrasonic flow converter is mounted directly on the UFS 3000 ultrasonic flow sensor

UFM 3030 K – EEx / FM / CSA (hazardous area locations)

UFM 3030 K

Separate Version
UFM 3030 F

UFC 030 F ultrasonic flow converter is remotely mounted from the UFS 3000 ultrasonic flow sensor

UFM 3030 F – EEx / FM / CSA (hazardous area locations)

UFS 3000 + UFC 030

Measurement functionality	Standard Optional	• Actual volume with simple single stage batching function • Corrected or standardized volume flow rate to API 2540 or customer specified • Customer specified mass flow (requires customer data)
Process conditions		Liquids with maximum solid particle content < 5% (by volume) or maximum gas content < 2% (by volume)
Communications protocols	Standard Optional	HART® Profibus PA
Measuring range		UFM 3030 measures a wide range of flow velocities, starting from v = 0 ft/s to 66 ft/s (0 m/s up to 20 m/s)
Measuring accuracy (under reference conditions)		
Measuring error (v = flow velocity)		v = 1.5 to 60 ft/s (0.5 to 20 m/s) < ± 0.5% of measured value v < 1.5 ft/s (0.5 m/s) < ± 0.1 inch/s (± 2.5 mm/s) of measured value
Measuring repeatability		± 0.2% of measured value
Influence of temperature		< ± 0.1% per 18°F (10°C)
Hazardous area approvals		ATEX IEC 529-EN 60 529, EEx de ib IIC Tb ... Ts, FM Class I, Div. 1 & 2, Groups A, B, C & D Class II, Div. 1, Groups E, F & G Div. 2, Groups F & G Class III, Div. 1 & 2 CSA Class I, Div. 1 & 2, Groups A, B, C & D Class II, Div. 1 & 2, Groups E, F & G Class III, Div. 1 & 2

Temperature limits

Compact version	
Medium temperature	-13°F to +284°F (-25°C to +140°C)
Ambient temperature	-40°F to 149°F (-40°C to +65°C)
Separate version	
Medium temperature	-13°F to +356°F (-25°C to +180 °C)
Ambient temperature	-40°F to 149°F (-40°C to +65°C)
Optional extended medium temperature	13°F to +428°F (-25°C to 220°C) up to 6 inch / DN150
Special versions	for medium temperatures ranging from -274°F to +932°F (-170°C to +500°C) available on request (HT/HP version)
Protection category	according to IEC 529 (EN 60 529)
Standard (separate and compact versions)	IP 67 (equivalent to NEMA 6 and 6P)
Optional for separate version	IP 65 (equivalent to NEMA 4 and 4X) or IP 68 (equivalent to NEMA 6 and 6P)

UFS 3000 Ultrasonic Flow Sensor

Flange connections

Diameter	Pressure rating / flange class*	Max. Pressure	Rating
To DIN 2501			
DN 25 - 80	PN 40	40 bar	580 psig
DN 100 - 150	PN 16	16 bar	230 psig
DN 200 - 2000	PN 10	10 bar	15 psig
DN 1200 - 2000	PN 6	6 bar	90 psig
DN 2200 - 3000	PN 2.5	2.5 bar	70 psig
To ANSI B 16.5			
1" - 24"	ANSI - Class 150 lb / RF	19.7 bar at 20°C	285 psig at 68°F
26" - 40"	MSS-SP44 - Class 150 lb / RF	19.7 bar at 20°C	285 psig at 68°F
To AWWA			
24" - 120"	ANSI - Class 150 lb / RF	6 bar at 20°C	90 psig at 68°F

* Other flange types, higher pressure ratings and materials available on request
For extensive overview, see the dimensions, weights and pressure section of this datasheet

Materials

Measuring tube (exterior polyurethane coated)	DN 25 - 300 / 1" - 12" SS 316 L (comparable to stainless steel 1.4404 and 1.4435) DN 350 - 3000 / 14" - 120" carbon steel
External sensor cover	≤ DN 65 / $2^1/_2$" SS 316 L ≥ DN 80 / 3" carbon steel ≥ DN 350 / 14" individual SS 316 L external transducer housing
Transducer/Transducer windows	SS 316 L
Flanges (exterior polyurethane coated)	< DN 65 / 2.5" SS 316 L > DN 80 / 3" carbon steel
Connection box (exterior polyurethane coated)	Die-cast aluminium

Patented transducer design

UFM 3030 - Cross section
Hermetically sealed 3-beam design

UFC 030 Ultrasonic Flow Converter

The converter has a backlit local display with three push buttons. All configuration data can either be entered by the push buttons or with the aid of a hand-held bar magnet and electromagnetic sensors, without opening the converter housing, or via the communication protocol (standard HART®). The compact converter (UFC 030 K) is mounted directly on the flow sensor, while the separate version (UFC 030 F) is supplied with a bracket for wall or pipe mounting.

Overall Functionality

Measurements available

Standard
- Continuous measurement of momentary volume flow rate and actual volume total
- Flow direction (forward or reverse)
- Velocity of Sound (VOS)
- Signal strength
- Self diagnostics
- Simple single stage batching

Optional
- Corrected or standardized volume flow rate to API 2540 or customer specified
- Customer specified mass flow (requires customer data)

Bidirectional measurement

Direction identified via status, pulse, or current outputs

Low flow cut-off

Cut-off active value 1-19%
Cut-off de-active value 2-20%
} programmable in increments of 1%

Time constant

0.025 - 99 seconds (set in increments of 0.01; 0.1 and 1.0 seconds)

Galvanic isolation

All inputs and outputs are galvanically isolated from the power supply, but not from each other

Power supply

mains supply
- 100 - 240 V AC (48-63 Hz) +10% / -15%

low voltage supply
- 24 V (AC or DC), AC: -10% / +15%, DC: 18 - 35 V

Power consumption
- approx. 10 VA (AC) or approx. 10 W (DC)

Current output

Function

Standard
- Continuous measurement of actual volume flow rate
- Flow direction indication (forwards and reverse)
- Velocity of Sound (VOS)
- Transducer signal amplification
- Pressure or temperature indication based on analog input (1) or (2)

Optional
- Corrected or standardized volume flow rate to API 2540 or customer specified
- Customer specified mass flow (requires customer data)

Settings

for Q = 0%; 0 - 16 mA
for Q = 100%; 4 - 20 mA
} programmable in increments of 1mA (Limit 20 - 22 mA)

Connection

Active mode: using internal power supply 24 V DC
Current sink, load ≤ 680 ohm
Passive mode: external voltage ≤ 18 ... 24 V DC, load ≤ 680 ohm

Pulse / Frequency / Status output

Function

Pulse output: pulse per volumetric unit (m^3, barrels, liters, US gallons or user defined volume unit per hour, minute, second or user defined time unit)

Standard
- Actual volume

Optional
- Corrected or standardized volume to API 2540 or customer specified
- Customer specified mass (requires customer specific density input)

Frequency output

Standard
- Continuous measurement of actual volume flow rate
- Velocity Of Sound (VOS)
- Transducer signal gain (dB)
- Pressure or temperature indication based on analog input (1) or (2)

Optional
- Corrected or standardized volume flow rate to API 2540 or customer specified
- Customer specified mass flow (requires customer specific density input)

Status output
- Diagnostics alarm path errors, totalizer overrun, all errors, analog input
- Flow direction indication (forwards and reverse)
- Batch volume reached
- Alarm trip point (high and low) based on actual volume flow rate

Settings

Pulse output: Pulse/unit (max. 2000 Hz) (example 1000 pulses/barrel) pulse duty cycle 25, 50, 100, 200, or 500 ms for frequency < 10 Hz

Frequency output: 0 to 2 000 Hz (example $Q_{0\%}$ - 0 Hz, $Q_{100\%}$ - 1000 Hz) at 100% of scale value, fmax - 2 kHz

Status output: On or Off

Voltage output = Uout:
Low: Uout < 5 V (off)
High: Uout > 15 V (on)
Max. Uout = 24 VDC

Connection

Pulse, frequency and status output:
- Active mode connection to electronic counters using internal power supply 24 V DC / I ≤ 50 mA
- Passive mode connection to electronic (EC) or electromechanical counters (EMC) external voltage, ≤ 19 - 32 VDC / I ≤ 150 mA

Analog input

Function
- Corrected volume version: two inputs to connect temperature and pressure signals for the corrected standard volume, according to API 2540, user defined volume or mass
- Measurement update 1 Hz

Setting

Input 1
- Unit: °Celsius or °Fahrenheit
- Temperature for 4 mA, maximum temperature range -58°F to 302°F(-50°C to 150°C)
- Temperature for 20 mA, maximum temperature range of -58°F to 302°F(-50°C to 150°C)

Input 2
- Unit: bar or psi
- Pressure for 4 mA, maximum pressure range 0 to 1450 psi (0 to 100 bar)
- Pressure for 20 mA, maximum pressure range 0 to 1450 psi (0 to 100 bar)

Connection

Input 1
- 4-20 mA for temperature sensor
- Load 58 Ohm
- Active (using UFC 030 24 V DC power) or passive

Input 2
- 4-20 mA for pressure
- Load 58 Ohm
- Active (using UFC 030 24 V DC power) or passive

Control input

Function
- Reset totalizer
- Acknowledge errors
- Force outputs to zero
- Initiate batch (see operating instructions for description of this function)

Setting
- On or Off

Connection

Input voltage (Uin)
- Low: Uin < 5 V (off)
- High: Uin > 15 V (on)
- Max.: Uin-max = 32 V

Local display

3-field backlit LCD
1st line 8 character 7 segment numeral and sign display and symbols for key acknowledgement
2nd line 10 character, 14 segment text display
3rd line 5 markers to identify display in measuring mode

Function

Standard
- Actual volume flow rate in m^3, barrels, liters, US gallons or user defined volume unit per hour, minute, second, or user defined time unit
- Actual volume total in m^3, barrels, liters, US gallons or user defined volume unit (positive, negative, and sum totals), minimum 1 year overflow time
- Velocity of sound in m/s or ft/s
- Errors (flashing display and error code)
- Signal strength (in dB)

Optional
- Corrected standard volume flow rate in m^3, barrels, liters, US Gallons or user defined volume unit per hour, minute, second or user-defined time unit
- Calculated mass flow rate in user defined mass unit
- Corrected standard volume total in m^3, barrels, liters, US Gallons or user defined corrected volume unit, minimum 1 year overflow time
- Calculated mass total in user defined unit, minimum 1 year overflow time
- Analog input in °C, °F, bar or psig

Language English, German or French

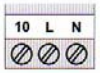
Housing

Die-cast aluminium (exterior polyurethane coated)

Signal cable

Only for separate versions, type MR06, O.D. = 0.43 inch (11 mm)
Standard: 5 m (15 ft)
Optional: 30 ft (10 m), 45 ft (15 m), 65 ft (20 m), 80 ft (25 m), 100 ft (30 m).
> 100 ft (> 30 m) on request

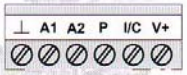
Electrical connections



10	Ground connection, not for protective earthing
L / 1L~	Live power supply
N / 0L~	Neutral power supply

PE	Protective earth connection
FE	Functional earth connection

Standard connection



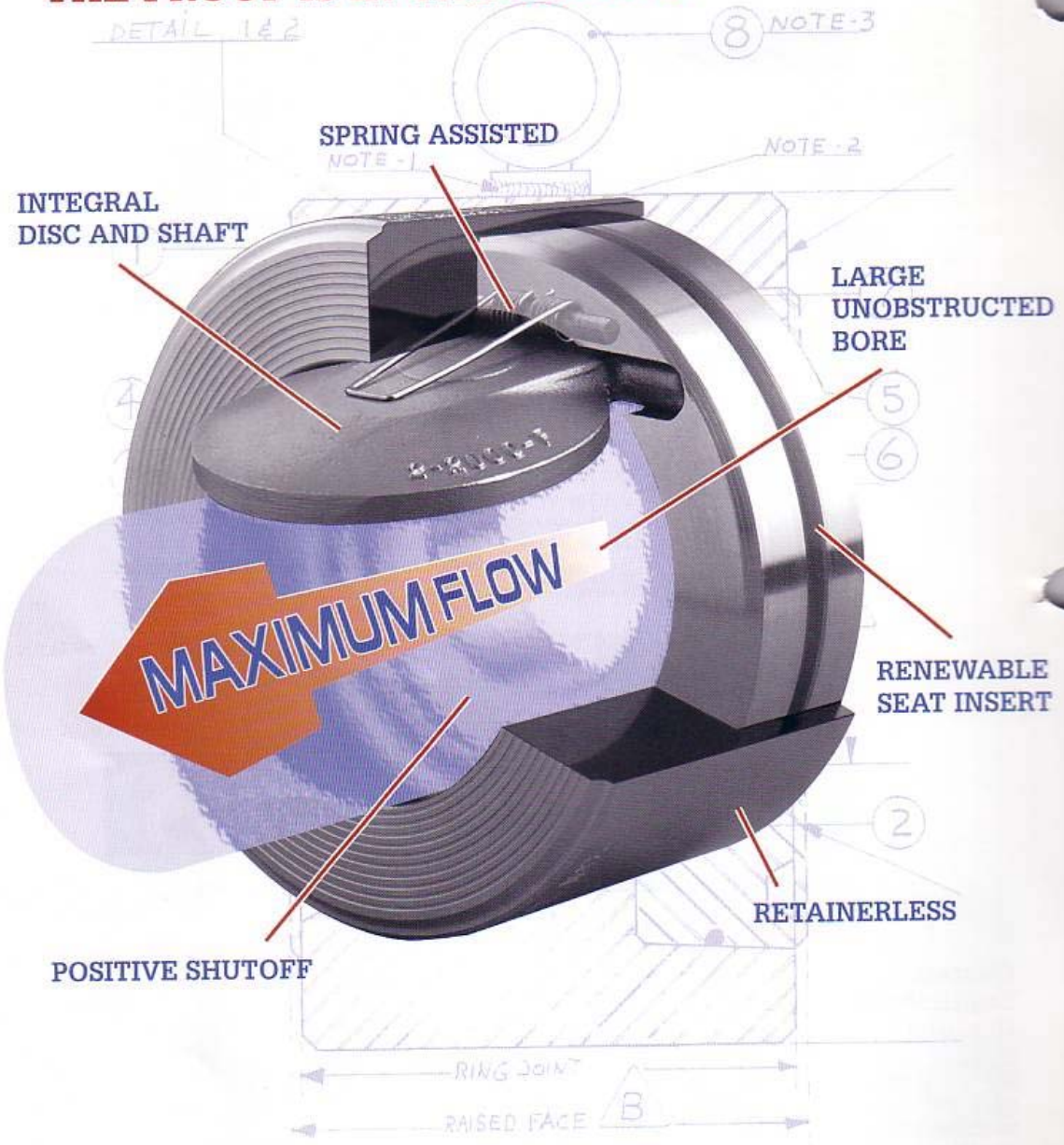
⊥	Common ground
A1	Analog input 1, for temperature measurement
A2	Analog input 2, for pressure measurement
P	Pulse, frequency or status output
I/C	Combined Current output (I) and Digital/control input (C) Current output (I) incl. HART communication
V+	DC power supply from converter for active wiring of inputs and outputs

Profibus connection

D+	Communication connection+
D-	Communication connection -
P/I/C	Combined current output (I), digital/control (C) and pulse output (P). See individual I/C terminal and P terminal functions

Valves

THE PROOF IS IN THE DETAILS



HY-GRADE VALVE, INC.
16250 Greeno Road (36532) P.O. Box 388 ▪ Fairhope, AL 36533
Phone: (334)928-1992 ▪ Fax: (334)928-3444 ▪ Internet:WWW.HY-GRADE.COM

Integral Flapper and Shaft

HY-GRADE's flapper and shaft are designed as an integral component with large diameter shafts to provide strength at a critical location. In contrast, typical check valves have multiple components which are assembled together using bushings, nuts, bolts, and hinge pins. Over time these multiple components tend to come apart leading to valve failure. HY-GRADE's integral flapper and shaft design has a long and proven history of providing reliable service in the harshest of applications.

High flows with Low Pressure Drop

HY-GRADE's Large Unobstructed Bore provides maximum flow capacity with extremely low pressure drops. The unobstructed bore also allows HY-GRADE check valves to be used in slurry, high consistency or abrasive applications.

COMPARE:

HY-GRADE's 3" Swing Check Valve Taper Style

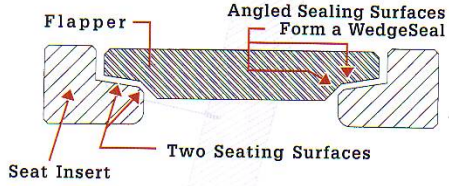
Typical 3" Split Disc Check Valve

Instant sealing and Anti-Chatter operation

A double wound torsion spring assists the flapper closure for instant sealing and anti-chatter operation. The spring is securely held in the valve body on an independent pin and is completely shielded from the flow.

Renewable seats

HY-GRADE check valves have a renewable seat insert for low cost and easy repairs.



Improved Special Metal-to-Metal seal

HY-GRADE developed the WedgeSeal to improve metal-to-metal sealing. As shown, the WedgeSeal has two seating surfaces which are machined at slight angles. As a result, positive shut off is obtained due to the wedging action of the sealing surfaces. Note, the sealing surfaces are machined only at slight angles to prevent the valve from sticking in the closed position in high back pressure applications. The WedgeSeal technology pioneered by HY-GRADE makes HY-GRADE metal seated check valves excellent for both low and high pressure applications.

HY-GRADE VALVE, INC.
16250 Greeno Road (36532) P.O. Box 388 ▪ Fairhope, AL 36533
Phone: (334)928-1992 ▪ Fax: (334)928-3444 ▪ Internet:WWW.HY-GRADE.COM

FTI
Valves and Controls

Modulating Control-V-Ball

Models:

Flanged Ends 150 & 300
3PC Threaded, SW & BW

FTI's V-Ball Design Is Characterized To Meet All Custom Flow Requirements

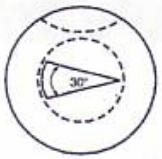
Modulating V-Ball Provides Accurate Control Of The Down Stream Flow Rates, From Simple On-off To Modulating Control Applications

ADVANCED DESIGN FEATURES:

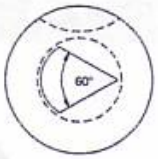
- Higher Flow Capacities
- Excellent Repeatability
- Bubble-Tight Shut-Off
- Controllable Flow Rates
- Non-Clogging Flow-Streams For General And Slurry Applications
- Compact Control Package Design
- Economical Low Operating Cost
- Self-Compensating Live-Loaded Stem Packing
- Maintenance Is As Easy As Changing A Seat In A Standard Ball Valve
- High Temperature Abrasion Resistant Seats
- Pneumatically Or Electrically Controlled, 3-15 PSI or 4-20 MA

Ball Valves Offer Higher Flow Capacities Than Comparable Globe Type Control Valves

TI'S V-PORT CHARACTERIZED BALL CONTROL VALV

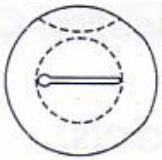


A. 30° V-PORT



B. 60° V-PORT

C. CUSTOM PORT



D. SLOTTED PO

TING

Durable Stainless Filled Teflon Seats are provided as standard with our Control Ball. The llent seat life and operate efficiently at higher pressures and temperatures. Full Metal Sea nal (consult factory).

W COEFFICIENT –CV

CHARACTERIZED BALL CONTROL VALVES (FULL PORT)

Line& Valve Size	Port Size	Percent of Rated Travel (Degree of Rotation)										
		0 (0)	10 (9)	20 (18)	30 (27)	40 (36)	50 (45)	60 (54)	70 (63)	80 (72)	90 (81)	100 (90)
1/2"	1/2" 30°V	0.00	0.000	0.001	0.048	0.171	0.379	0.676	1.057	1.516	2.040	2.550
1/2"	1/2" 60°V	0.00	0.000	0.001	0.089	0.338	0.764	1.371	2.168	3.172	4.429	6.040
3/4"	3/4" 30°V	0.00	0.000	0.001	0.052	0.192	0.435	0.785	1.237	1.783	2.410	3.100
3/4"	3/4" 60°V	0.00	0.000	0.002	0.108	0.397	0.884	1.577	2.483	3.622	5.048	6.870
1"	1" 30°V	0.00	0.000	0.040	0.244	0.652	1.283	2.141	3.213	4.475	5.890	7.410
1"	1" 60°V	0.00	0.000	0.082	0.489	1.286	2.498	4.137	6.217	8.779	11.92	15.81
1-1/4"	1-1/4" 30°V	0.00	0.000	0.100	0.466	1.149	2.176	3.549	5.247	7.227	9.431	11.78
1-1/4"	1-1/4" 60°V	0.00	0.000	0.211	0.968	2.351	4.400	7.130	10.56	14.76	19.87	26.14
1-1/2"	1-1/2" 30°V	0.00	0.000	0.060	0.481	1.374	2.790	4.739	7.195	10.10	13.38	16.93
1-1/2"	1-1/2" 60°V	0.00	0.000	0.140	1.096	3.081	6.170	10.39	15.79	22.48	30.71	41.00
2"	2" 30°V	0.00	0.001	0.237	1.077	2.637	4.977	8.100	11.96	16.45	21.45	26.77
2"	2" 60°V	0.00	0.001	0.524	2.344	5.653	10.54	17.04	25.21	35.20	47.34	62.22
2-1/2"	2-1/2" 30°V	0.00	0.001	0.382	1.663	4.013	7.519	12.18	17.93	24.61	32.04	39.93
2-1/2"	2-1/2" 60°V	0.00	0.001	0.840	3.598	8.552	15.83	25.49	37.61	52.40	70.34	92.30
3"	3" 30°V	0.00	0.001	0.395	2.032	5.171	9.947	16.37	24.35	33.70	44.13	55.28
3"	3" 60°V	0.00	0.001	0.866	4.380	10.98	20.85	34.08	50.79	71.29	96.28	127.1
4"	4" 30°V	0.00	0.117	1.579	5.072	10.92	19.27	30.07	43.12	58.08	74.46	91.60
4"	4" 60°V	0.00	0.250	3.327	10.53	22.35	39.01	60.60	87.26	119.4	157.8	204.0

CHARACTERIZED BALL CONTROL VALVES (STANDARD PORT)

Line& Valve Size	Port Size	Percent of Rated Travel (Degree of Rotation)										
		0 (0)	10 (9)	20 (18)	30 (27)	40 (36)	50 (45)	60 (54)	70 (63)	80 (72)	90 (81)	100 (90)
2"	1-1/2" 30°V	0.00	0.000	0.058	0.462	1.320	2.677	4.537	6.861	9.567	12.54	15.64
2"	1-1/2" 60°V	0.00	0.000	0.137	1.077	3.023	6.033	10.08	15.07	20.85	27.24	34.00
2-1/2"	2" 30°V	0.00	0.001	0.196	0.889	2.177	4.105	6.668	9.805	13.41	17.33	21.37
2-1/2"	2" 60°V	0.00	0.001	0.482	2.155	5.190	9.643	15.47	22.55	30.70	39.70	49.27
3"	2-1/2" 30°V	0.00	0.001	0.317	1.380	3.330	6.234	10.08	14.79	20.20	26.08	32.17
3"	2-1/2" 60°V	0.00	0.001	0.771	3.302	7.841	14.47	23.14	33.68	45.90	59.51	74.17
4"	3" 30°V	0.00	0.001	0.296	1.521	3.870	7.437	12.21	18.09	24.85	32.21	39.80
4"	3" 60°V	0.00	0.001	0.738	3.734	9.345	17.68	28.65	41.98	57.27	73.99	91.50
6"	4" 30°V	0.00	0.080	1.074	3.452	7.427	13.08	20.36	29.05	38.80	49.15	59.57
6"	4" 60°V	0.00	0.198	2.625	8.300	17.58	30.51	46.84	66.04	87.38	109.9	132.6

ıre is general in nature and manufacturer reserves the right to alter dimensions, materials or to make desig

LUBRIZOL
Performance Systems

Standard Materials

Body & Cover:	Cast Steel ASTM A216
Coating:	Fusion Bonded Epoxy
Trim:	316 Stainless Steel
Elastomers:	Buna-N (special order)) Viton (standard)
Stem, Nut & Spring:	Stainless Steel
Control:	***Dual Solenoids with Needle Valve Opening/Closing Speed Adjustment***
Connections:	***ANSI RF Flanges***

Digital Control **Valves**

Reducing the Burden of Ownership

Description

Lubrizol Performance Systems Digital Control Valves are full port, single chamber, basic valve globe designs. They incorporate a custom porfiled plug and seat assembly, permitting nearly linear flow characteristics. The diaphragm and plug assembly are actuated by upstream proudct pressure, ensuring positive control over a broad range of flow. An internal spring ensures fail-safe closed operation in case of loss of upstream pressure. This valve will not prevent reverse flow and therefore does not need a separate downstream pressure relief valve. If reverse flow is a problem in your application, a separate means of controlling reverse flow should be engineered into the installation.

Maximum Operating Pressure:
150# Flanged Valve = 250 psi

Maximum Operating Temperature
Buna-N: 160° Maximum
Viton: 250° Manimum

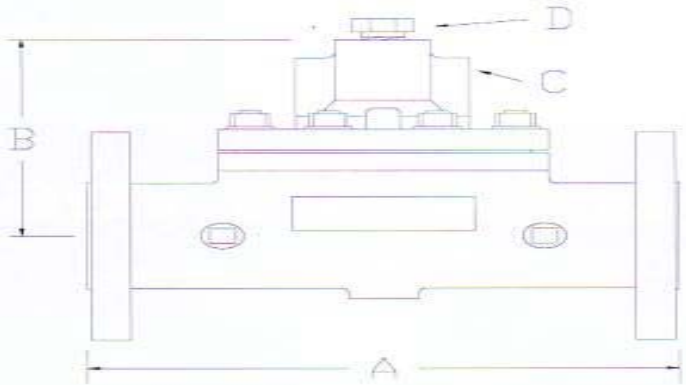
- Maximum continuous flow based on pipeline velocity of 20ft per second
- Maximum intermittent flow based on pipeline velocity of 25ft. per second
- The C_v faxtor of a valve is the flow rate in US GPM at 60° F that will cause a 1psi drop in pressure
- The factors stated are based upon a fully open valve
- C_v factor can be used in the following equations to determine Flow (Q) and Pressure Drop (P):

$$Q\ (\text{Flow}) = C_v \sqrt{\Delta p}$$

$$\Delta p\ (\text{Pressure Drop}) = (Q/C_v)^2$$

ZOL
ce Systems

Model	VALVE SIZE	A GLOBE 150#	B COVER TO CENTER	C PORT SIZE	D PORT SIZE	SHIPPING WEIGHT
GC150	1 1/2	8	5 1/2	1/4	1/2	25
GC200	2 Inch	8	6 - 1/2	1/4	1/2	35
GC400	4	13-1/2	10-5/8	1/2	1/2	105
GC600	6	17	13-3/8	1/2	3/4	165



Valve Size Inches	Maximum Continuous Flow Rate GPM	Maximum Intermittent Flow Rate GPM	Cv Fa GPM (G
1-1/2	130	161	35
2	210	265	54
4	800	1000	21
6	1850	2300	46

ol Performance Systems Inc.
orthfield Court, Roswell, GA 30076 USA
'0) 475-1900 Fax: (770) 475-1717

• Lubrizol Performance Systems Ltd.
6 Pennant Park, Standard Way, Fareha
Tel +44 1329 825 823 Fax +44 1329 82

Hoses, Swivels, Loading Arms & Couplers

- Kanaflex
- OPW Swivels
- OPW Loading Arms
- OPW API Couplers
- EMCO Wheaton Couplers K2 & K2P
- Civacon Vapor Coupler
- EMCO Wheaton Greaseless Swivel

Applications: Gasoline vapor recovery only

Construction: Nitrile rubber, rigid PVC helix, smooth bore, corrugated O.D.

Features:
- Lightweight and flexible
- Available with static grounding wire: ST 120 VP NEW

Temp. Range:
- -40°F to 140°F

I.D.	O.D.	PITCH	Min Bend Radius	Working Pressure	Bursting Pressure	Vacuum Rating	Weight
(Inches)	(Inches)	(Inches)	(72F, Inches)	(72F, PSI)	(72F, PSI)	(72F, In/Hg)	(Lbs./Ft.)
2	2.35	0.39	3.0				0.56
3	3.48	0.59	2.5				0.92
4	4.60	0.65	5.0				1.60

ST 120 LT

Applications:
- Gasoline tank truck gravity drop hose for such items as naphtha, kerosene, light and heavy oil, and gasohol

Construction:
- Nitrile rubber, rigid PVC helix, synthetic braiding, smooth bore, corrugated O.D.

Features:
- Lightweight and flexible
- External helix provides for easy drag
- Rated for up to 40% aromatic content
- Static grounding wire

Temp. Range:
- -30°F to 140°F

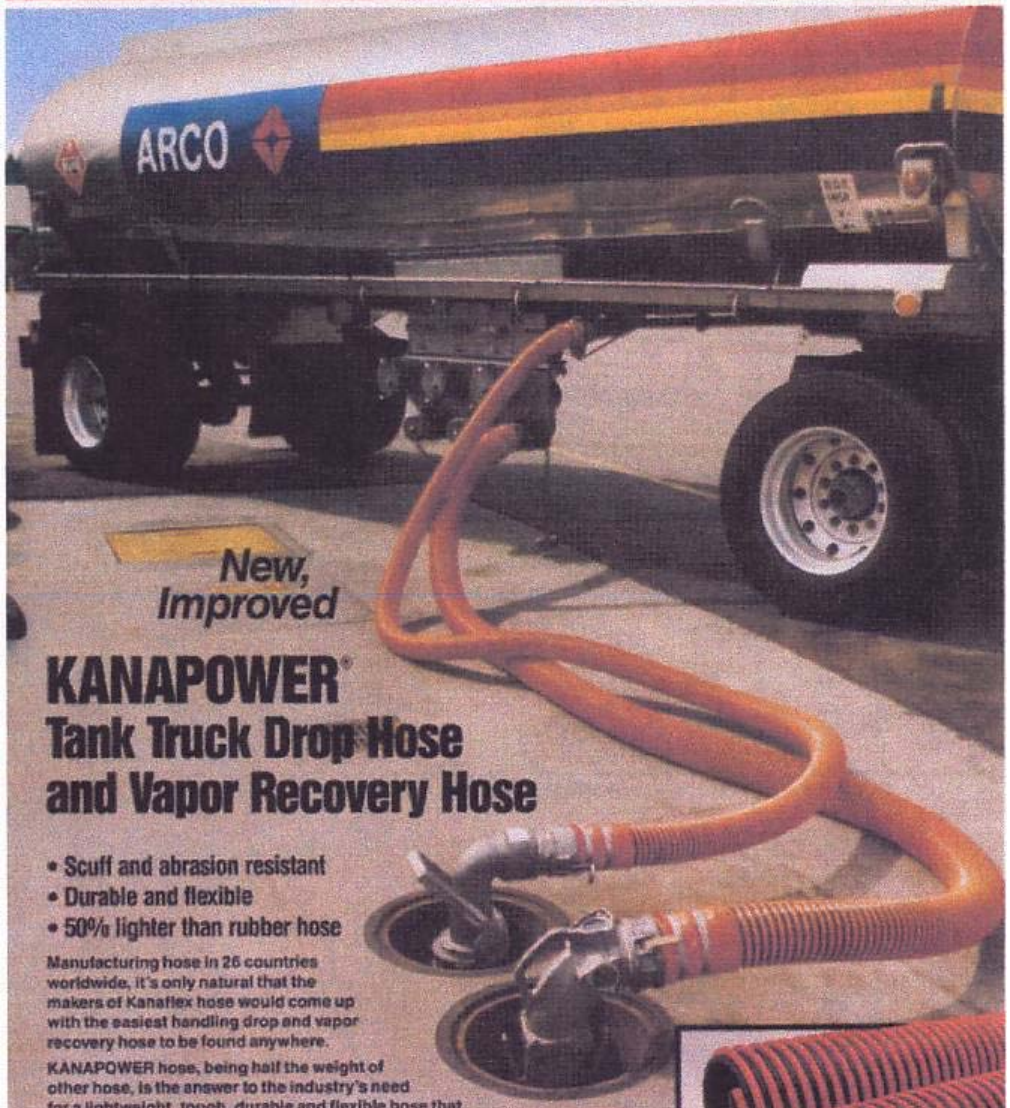
I.D.	O.D.	PITCH	Min Bend Radius	Working Pressure	Bursting Pressure	Vacuum Rating	Weight
(Inches)	(Inches)	(Inches)	(72F, Inches)	(72F, PSI)	(72F, PSI)	(72F, In/Hg)	(Lbs./Ft.)
2	2.68	0.39	5.0	65	260	29.8	1.13
3	3.62	0.59	6.0	65	260	29.8	1.37
4	4.80	0.65	8.0	65	260	29.8	2.16

Banding Sleeve

Note:
- Banding sleeves must be used for 3" and 4" sizes.

180 BL

Kanaflex



New, Improved

KANAPOWER®
Tank Truck Drop Hose and Vapor Recovery Hose

- Scuff and abrasion resistant
- Durable and flexible
- 50% lighter than rubber hose

Manufacturing hose in 26 countries worldwide, it's only natural that the makers of Kanaflex hose would come up with the easiest handling drop and vapor recovery hose to be found anywhere.

KANAPOWER hose, being half the weight of other hose, is the answer to the industry's need for a lightweight, tough, durable and flexible hose that makes drop deliveries easier for drivers. Both hoses have been designed to handle unleaded gasoline and up to 15% gasohol. Constructed of our own blend of static dissipating Nitrile and T-Polymer, KANAPOWER DROP HOSE is manufactured in 3" and 4" sizes.

Available lengths are 60' and 100'. KANAPOWER VAPOR RECOVERY HOSE is manufactured in 2", 3" and 4" and is also available in 60' and 100' lengths.

MADE IN U.S.A.

Kanapower® ALL WEATHER
TANK TRUCK DROP HOSE AND VAPOR RECOVERY HOSE

SPECIFICATIONS

Tank Truck Drop Hose . . . Series 120 LT

NOMINAL I.D. Inches	O.D. Inches	MIN. PITCH, Inches	MIN. BENDING RADIUS Inches	WORKING PRESSURE P.S.I.	BURSTING PRESSURE P.S.I.	Weight Lbs./Ft.	LENGTH Per Coil
3	3.62	0.59	6.0	65	260	1.27	60' and 100'
4	4.80	0.65	8.0	65	260	2.00	60' and 100'

Temperature range: -30°F to 158°F. Banding sleeves must be used; 9" length recommended for each end.

Tank Truck Drop Hose (w/static grounding wire) . . . Series ST 120 LT

2	2.68	0.39	5.0	65	260	1.13	60' and 100'
3	3.62	0.59	6.0	65	260	1.37	60' and 100'
4	4.80	0.65	8.0	65	260	2.16	60' and 100'

Temperature range: -30°F to 158°F. Banding sleeves must be used; 9" length recommended for each end.

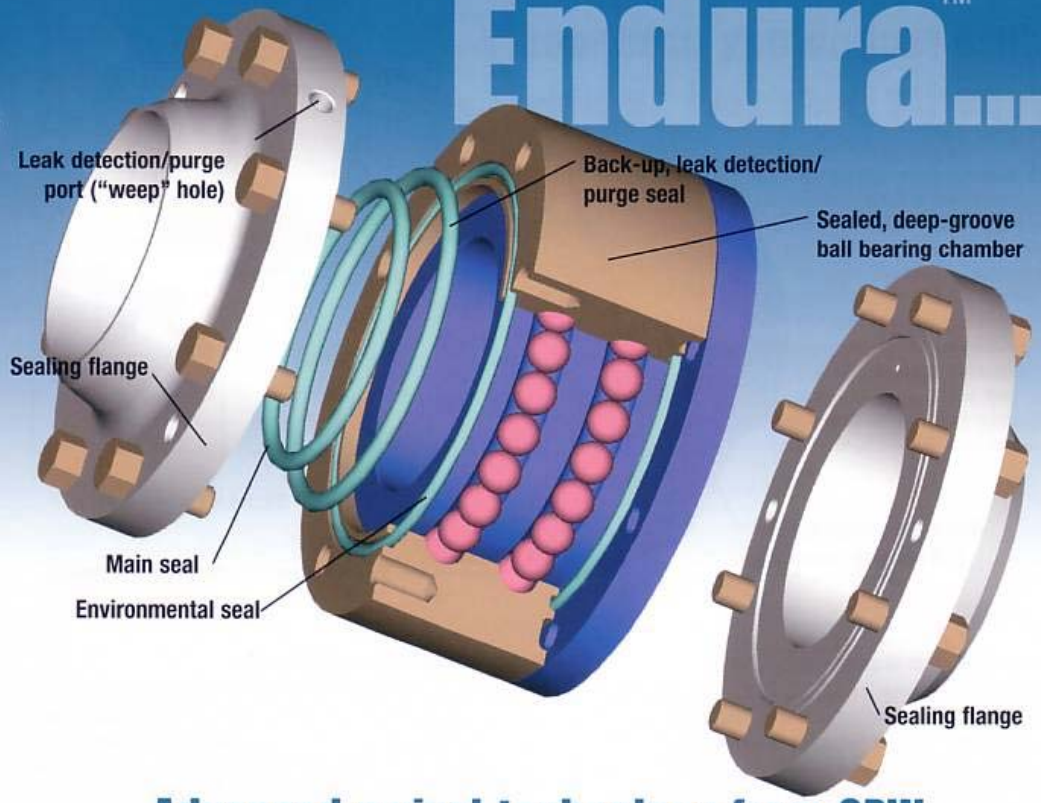
Vapor Recovery Hose . . . Series 120 VP

2	2.35	0.39	3.0	–	–	.56	60' and 100'
3	3.48	0.59	2.5	–	–	.92	60' and 100'
4	4.60	0.65	5.0	–	–	1.60	60' and 100'

Temperature range: -40°F to 158°F.

DISTRIBUTED BY:

Endura™...



Advanced swivel technology from OPW

Endurance. Reliability. Ease of maintenance. Presenting Endura, OPW's line of technologically advanced swivels. Available in dual split-flange and hose reel styles, Endura sets new standards in swivel performance and cost-effective operation. Both styles feature easy 360° rotation and a patent-pending, three-piece design that is simplicity itself. Ideal for the transfer of hazardous materials such as LPG, acids, solvents, petrochemicals and other toxic fluids.

Endura Dual Split-Flange (DSF) Swivel...

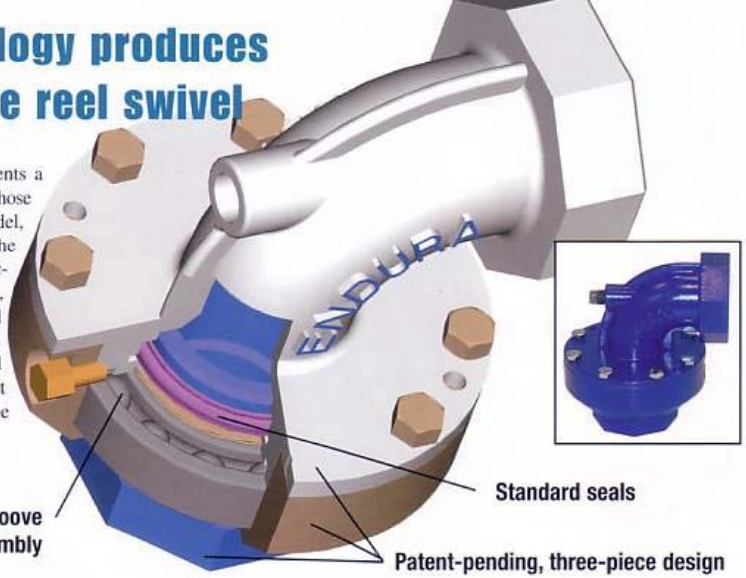
Where less is more OPW's Endura DSF swivel proves that simple is better. Consisting of just three major components – two sealing flanges and a ball bearing chamber – no other unit is easier or less expensive to maintain. If seal replacement becomes necessary, simply remove the flange bolts for fast, easy access. And with deep-groove ball bearing technology, there are no individual balls to handle. Bearing maintenance is a simple matter of replacing the old bearing-chamber with a new one. There is less downtime, less labor and, ultimately, less cost.

Built-in leak detection The Endura's unique sealing system incorporates a main seal, back-up seal and built-in leak detection. If the main seal ever starts leaking due to normal wear and tear, the back-up seal will contain the fluid before it can escape. Any leakage is then channeled to a "weep" hole in the side of the sealing flange, providing a visual indicator that servicing is required. Maintenance can be scheduled before major problems arise, avoiding unexpected – and very expensive – downtime. The weep hole can alternately serve as a purge port, permitting use of an inert blanket of gas to prevent product from escaping into the environment.

The versatile performer OPW's Endura DSF swivel is ideally suited for chemical and petrochemical loading arm applications. Featuring heavy-duty flange construction, Endura is available in a range of materials including carbon steel, stainless steel, Hastalloy®, Alloy 20® and other exotics. Seals are offered in a variety of elastomers. Units meet the "National Standards For

Endura technology produces a superior hose reel swivel

OPW's Endura technology represents a major advancement in the design of hose reel swivels. As with the DSF model, the secret lies in the simplicity of the patent-pending, three-piece construction. Endura quickly disassembles, and the one-piece, deep-groove ball bearing can be replaced in a single step. Add readily available standard seals... and you have a unit that significantly reduces maintenance costs and expensive downtime.



High rotation, low load design

Endura's low breakaway torque and 360° rotation permit easy hose reel operation while connected to the fluid source. The deep-groove ball bearing assembly ensures smooth performance and is guaranteed for life. Ideally suited for use with propane and other liquid gases, Endura meets the UL 567 Standard in 1-1/2" and 2" sizes.

Endura — the "reel" difference

Endura is the best-performing, most cost-effective hose reel swivel on the market today. It is available in 1-1/2, 2 and 3-inch sizes in multiple construction and seal materials. Dimensionally equivalent to most other swivels, retrofitting is a snap. Units meeting the "National Standards For Cold Weather Service" are optional.

ENDURA SWIVELS

Endura DSF and hose reel swivels are available in a variety of sizes, styles, construction and seal materials as indicated below. Available end connections include flanged, threaded, welded and combinations. For complete pricing and ordering information, contact your OPW distributor or sales representative.

8420 - 0301

CONSTRUCTION
74 - Steel Hose Reel
79 - 316 SST Hose Reel
84 - Steel Dual Split Flange (DSF)
89 - SST Dual Split Flange (DSF)

Alloy 20®, Hastalloy®, Monel® and other exotics available

STYLE
10 20 30 40 50 56
58 60 70 76 78 80

SIZE
015 - 1-1/2"
020 - 2"
030 - 3"

SEAL MATERIAL
1 - Buna-N (Standard)
2 - Viton®
4 - EPT

Additional seal materials (i.e. Kalrez®, Chemrez®, Silicone, Food Grade) available

opw Engineered Systems

2726 Henkle Drive • Lebanon, OH 45036
(800) 547-9393 or (513) 932-9114
Fax (800) 245-8536 or (513) 932-9845
e-mail: opwsales@opw-es.com
web site: www.opw-es.com

OPW Fluid Transfer Group Europe
Tel +31 (0)252 660 300
Fax +31 (0)252 620 204

A DOVER COMPANY

ISO 9001 CERTIFIED

PATENT PENDING

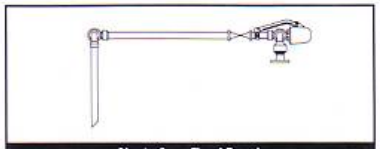
1004D2 BOTTOM LOADING COUPLER

NEW Higher Pressure Rating!

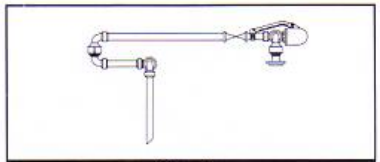
- 300 psi (20 bar) pressure rating
- Unique high-retention beveled nose seal for superior sealing
- Easy and inexpensive to maintain
- Designed to effectively handle all fuels
- Easy-to-change nose seal
- Built-in roller bearing on operating lever
- Large, convenient grasp handles
- Durable, reliable and simple to use

OPW Engineered Systems

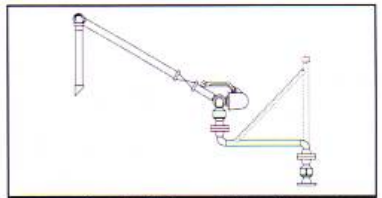
OPW Loading Arms



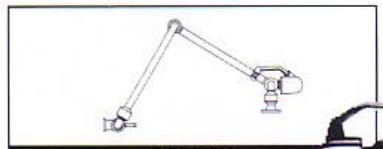
Single Arm, Fixed Reach



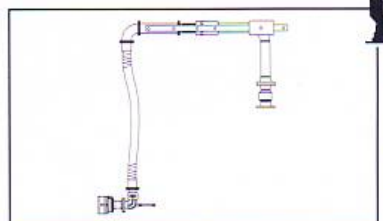
Scissor Arm



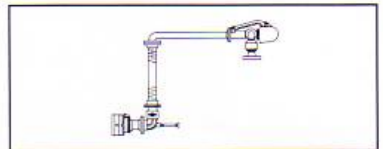
Supported & Unsupported Boom Arm



A-Frame Arm



Counterweighted Hose Loader



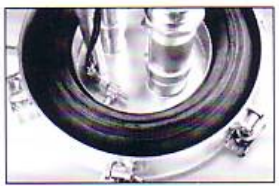
Spring Balanced Hose Loader

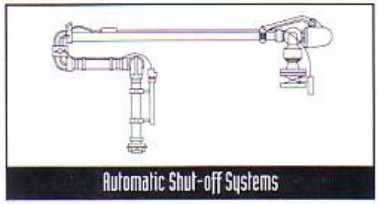
New OPW inflatable hatch seal facilitates vapor recovery in top loading applications through multiple size hatch openings. →

Loading arm assemblies from OPW are designed and built to meet your exact requirements. Using the latest advancements in computer-aided design, we rapidly engineer, manufacture and deliver systems with precisely the horizontal and vertical range required for your specific applications.

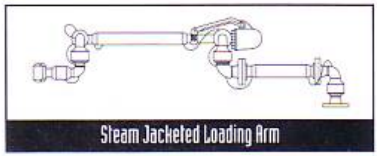
Whether you're transferring petroleum products, asphalt, liquified gases, solvents , or hazardous, corrosive chemicals, OPW loading arm assemblies help streamline your operation. They eliminate the expense of hose replacement while reducing labor costs and offer an efficient, easy-to-use alternative to bulky, clumsy hoses for loading and unloading tank trucks and rail cars.

With such features as fully adjustable torsion spring balance mechanisms, and precision machined ball bearing swivel joints, OPW loading arms are durable, reliable, easy to operate and maintain. Available in stainless steel, carbon steel, aluminum and other materials, OPW systems meet your most demanding specifications. Our special capabilities include heat traced and jacketed arms, vapor recovery, automatic shut-off, special valving, by-pass systems, lined and coated loaders, pneumatic/hydraulic arms and drum fillers.

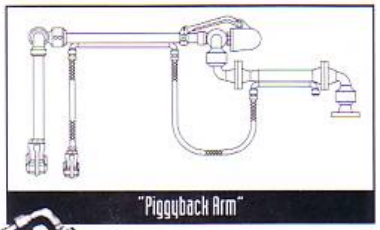




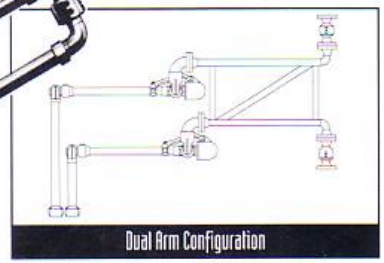
Automatic Shut-off Systems



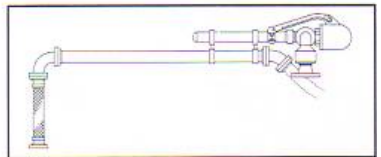
Steam Jacketed Loading Arm



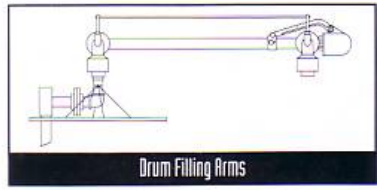
"Piggyback Arm"



Dual Arm Configuration



By-Pass Loading Arms



Drum Filling Arms

OPW Engineered Systems

ISO 9001 Certified

2726 HENKLE DRIVE
LEBANON, OHIO 45036
PHONE (800) 547-9393 OR (513) 932-9114
FAX (800) 245-8536 or (513) 932-9845
www.opw-es.com

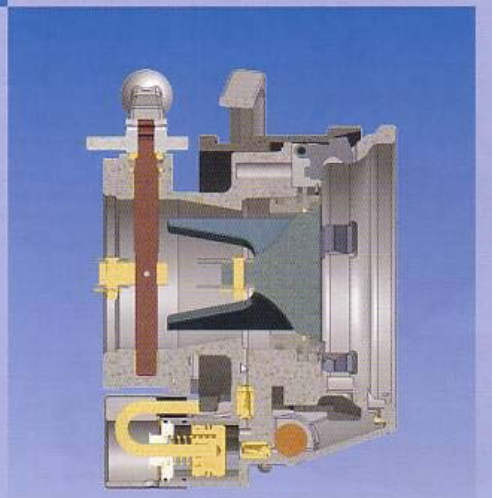
A DOVER COMPANY

Introducing K2 & K2P World Series API Couplers

Snap On/Snap Off, High Pressure 4" API Bottom Loading Coupler

K2P featuring patented return pump to put drips back in the line, not on the ground.

"Smart ideas in action to protect your people, and our environment."



EMCO WHEATON™

www.emcowheaton.com

K2 & K2P World Series API Couplers

- K2 snap on/snap off couplers
- Effortlessly connects and disconnects from API adapters, even when the coupler is misaligned due to hose crossover
- 5 lug design with 300 psi pressure capability*

When dripping couplers are not an option, the K2P is the only solution

- No Drips! Patented return pump on the K2P returns residual fuel back to the line after loading**
- Reusable filter prevents dirt entering the pump
- Built to API recommended practice
- Hard anodized aluminum with a 4" TTMA mounting flange

Part #	Description***	Weight
K2-151	4" API Coupler with HP Viton® seals; Handle on top; No pump	18.8 lbs.
K2-152	4" API Coupler with Buna® seals; Handle on top; No pump	18.8 lbs.
K2P-151	4" API Coupler with HP Viton® seals; Handle on top; With pump	21.5 lbs
K2P-152	4" API Coupler with Buna® seals; Handle on top; With pump	21.5 lbs

* 300 psi pressure capability when coupler is in the closed position, is proof of the design and integrity of the coupler. This is not a system design recommendation and only refers to the coupler.

** K2P couplers are not suitable for use when parked more than 15° below horizontal.

*** Side mounted operating lever available upon request.

ISO 9001 CERTIFIED

FM 40350

EMCO WHEATON

A Division of Syltone Industries LLC
2501 Constant Comment Place
Louisville, KY 40299
US Tel: 800-285-3626
Int'l. Tel: 502-266-8767
Fax: 502-266-5873

Distributed By:

civacon
CARGO TANK PRODUCTS GROUP

Products & Services

Introducing Civacon's New 633 CPP Vapor Coupler.

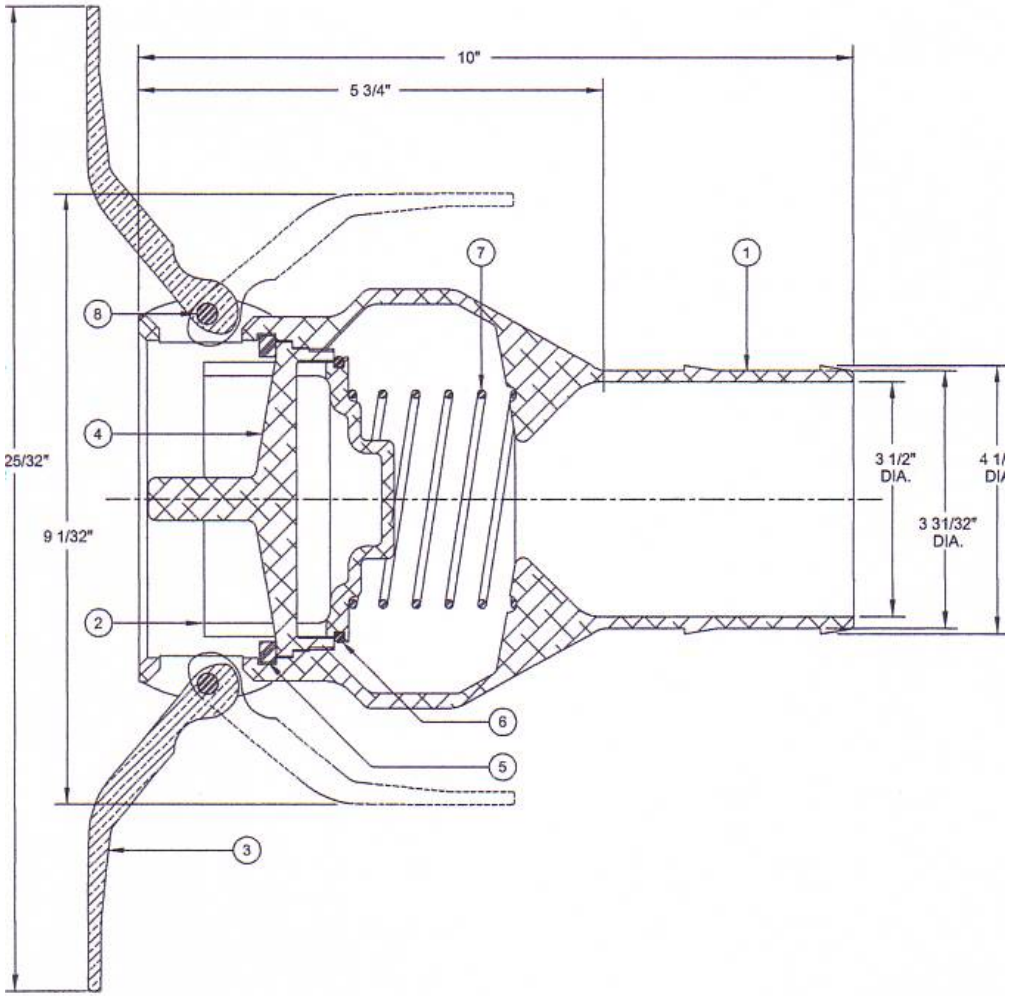
Higher flow rates. Lower pressure drops.

Field tests show Civacon's new 633 CPP Vapor Coupler reduces pressure drop across the fitting by 50%*. Proof positive that the 633 CPP Coupler is engineered to help you safely meet operational demands, while delivering superior performance.

*Pressure Drop from 12" to 6" (measured in inches/water) across Civacon 633 CPP/Civacon 633 LVH coupling realized while simultaneously filling three compartments at 600 GPM (gallons per minute).

633 CPP Vapor Coupler

633CPP-4040 VAPOR RECOVERY COUPLER



EM	PART NUMBER	DESCRIPTION	QTY.
1	E51839A	BODY	1
2	C02844AH	POPPET	1
3	D00272B	PADDLE ARM	2
4	C02843AH	GUIDE RING	1

ITEM	PART NUMBER	DESCRIPTION	QTY.
5	H08945M	GASKET (BUNA)	1
6	H07408M	O-RING (BUNA)	1
7	H52130M	SPRING	1
8	H20144M	GROOVE PIN	2

04 Mattox Road
nsas City, MO 64150

civacon™

Phone: 888-526-5657
Fax: 888-634-1433

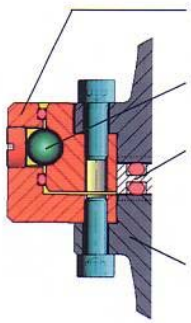
D2000 SWIVEL JOINT

The D2000 world series swivel joint is the ultimate in swivel joint technology, specifically designed for the petroleum, chemical, compressed gas, food, and bulk powder industry.

"DESIGNED FOR LONG LIFE AND EASE OF OPERATION"

- Heavy duty dual split flange design
- 5 year limited warranty
- Low Profile to reduce overall height and bend radius
- Ultra low maintenance
  - No field greasing required for five years
  - Simply unbolt either of the flanges to remove seal
  - No ball bearings to remove
- Available in 2", 3", 4", & 6"

"MADE FOR TOUGH APPLICATIONS"



Bearing module is removed from the liquid path for outstanding performance with aggressive chemicals

"Deep Groove" ball bearing technology provides "best in class" load carrying capacity

Seal options:

- Spring engergized lip seal
- H-Block PTFE carrier seal with an extensive range of O-Ring elastomers

Removable flanges can be made from many materials

EMCO WHEATON

A SYLTONE COMPANY

Tel: (800) 285-3626
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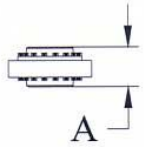
Fax: +1 (502) 266-5873
email: sales@syltone.com

D2000 SWIVEL JOINT



Size	A Dimension	Weight
2"	3.86"	12.5 lbs
3"	3.86"	16.0 lbs
4"	3.86"	21.0 lbs
6"	6.29"	74.0 lbs

SEAL OPTIONS

BUNA H-BLOCK
EPDM H-BLOCK
VITON H-BLOCK
PTFE H-BLOCK
PTFE LIP SEAL
FLUOROLOY K LIP SEAL

GREASE OPTIONS

STANDARD (CHEVRON DURALITH)
HIGH TEMP (DOW CORNING 44)
LOW TEMP (DOW CORNING 33)
FOOD GRADE (BEL-RAY NO TOX)
CHEMICAL GRADE (DOW CORNING 3451)

FLANGE OPTIONS

304 STAINLESS STEEL
316L STAINLESS STEEL
ALLOY 20
ALUMINUM
CARBON STEEL
DUPLEX STAINLESS
LOW TEMP CARBON STEEL
MONEL

NEW PART NUMBERS! In order to create some uniformity with our swivel joint part numbers, we have developed a numbering system that corresponds with steps 1-7 above. The illustration below shows how to build the part #.

S20 — STYLE
S20 S30
S40 S50
S60 S70
S80 S10

D2000 — SWIVEL
D2000
D1070
D0116
D0002
D1010

02 — PIPE SIZE
02=2" 03=3"
04=4" 06=6"
08=8" 10=10"
12=12" 16=16"
20=20" 24=24"

1 — MAT
0=CST
1=SST

01 01 — CONNECTIONS
01=BUTTWELD
02=150# FLANGE
03=300# FLANGE
04=TTMA FLANGE
05=FNPT

3 — SEAL
1=BUNA
2=VITON
3=PTFE

EMCO WHEATON

A SYLTONE COMPANY

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MEMBER PEI

REGISTERED TO ISO 9001:1994

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email: sales@syltone.com
Web: www.emcowheaton.com

Detonation Flame Arrestor

- Flame Arrestors
- Enardo
- Vapor Recovery Units
- Enviro Burners

ENARDO DFA SERIES

DETONATION FLAME ARRESTOR

- Proven Performance - Tested to Worldwide Standards
- Superior Pressure Drop to Flow
- Minimal Clogging and Ease of Cleaning
- Hinged removable Element
- Bi-directional Protection

ENARDO DESIGN

The Enardo design represents the best value in flame arrestor protection. Detonation Flame Arrestors provide protection against flame propagation in piping systems that are manifolded or have long run-up distances. Enardo utilizes a *patented* element assembly, that dampens the high velocities and pressures associated with deflagrations and detonations while quenching the flame front. Our design is unique in the ability to provide larger flame channels which requires less frequent maintenance and greater ease in cleaning when service is required, translating to less down time. Our patented element offers maximum flow to pressure drop characteristics enhancing the value of our product to any system.

PROVEN PERFORMANCE

These arrestors are bi-directional and are proven to stop an ignited flammable vapor mixture approaching from either direction that can be traveling at subsonic or supersonic velocities. Our models have been tested to the U.S. Coast Guard Standard as published in the Federal register; Appendix A to 33 CFR Part 154 to NEC gas group types D, C and B. They are also recognized by and tested to world standards; Canadian Standard Association (CSA) Z343 Rv. 12, British Standards Institute (BSI) 7244: 1990, and German Standards by Physikalisch-Technische Bundesanstalt (PTB).

CONSTRUCTION

All welding is performed in accordance with ASME Boiler and Pressure Vessel Code Section VIII and documented in the Enardo Quality manual in accordance with ISO 9001.

Standard Materials: Housing is ASTM A234 and 304 or 316 stainless steel material with ASTM A-36 carbon steel shell.

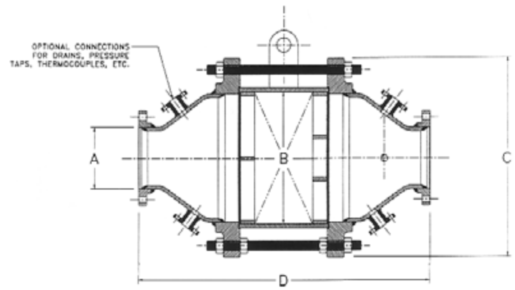
Options: All stainless steel or special alloy materials, flanged or NPT fittings for drains, pressure taps, temperature probes and cleaning ports. *Eccentric and custom designs for unique applications are a specialty easily accomodated at Enardo.* Auxiliary systems for automatic cleaning, flame sensor notification, shutdown, inerting and or enriching systems.

Gas Vapor Specifications: Designs for MESG value not less than 0.90 mm, NEC Group D (IEC Group I & IIA). MESG value not less than 0.65 mm for NEC Group C (IEC Group IIB). MESG value 0.28 mm for NEC Group B (IEC Group IIC).

ORDERING INFORMATION

Consult Enardo technical sales personnel with specific application data for model selection. Information required would include; Connection size, Operating/maximum rate of flow, system pressure, desired pressure drop, gas vapor specification, placement in piping, housing and element materials, desired options.

ENARDO MANUFACTURING CO.
4470 S. 70th E. Ave.
Tulsa, OK 74145-4607
(918) 622-6161
(800) 336-2736 U.S. and Canada
FAX: (918) 622-0004
Email: sales@enardo.com



	A	B	C	D
MODEL	CONNECTION SIZE	HOUSING SIZE	OUTSIDE DIAMETER	OVERALL LENGTH**
DFA-401	1"	4"	9"	20"
DFA-602	2"	6"	11"	24"
DFA-803	3"	8"	13-½"	26"
DFA-1004	4"	10"	16"	32"
DFA-1206	6"	12"	19"	36"
DFA-1608	8"	16"	25-½"	51-¼"
DFA-2010	10"	20"	30-½"	62-¾"
DFA-2412	12"	24"	36"	64-½"
DFA-2814	14"	28"	40-¼"	70"
DFA-3016	16"	30"	43"	79"
DFA-3418	18"	34"	47-½"	89"
DFA-3620	20"	36"	50"	89"
DFA-4824	24"	48"	57-¾"	93"

(DIMENSIONS SHOWN ARE FOR REFERENCE ONLY)

**Due to variation in the manufactured components these dimensions may vary somewhat from those given in the table. Installation piping should be designed to all for a tolerance of ± 1.0 inch. If your needs require a given dimension, we can manufacture parts to a specific tolerance.

KEY TO ENARDO DETONATION FLAME ARRESTOR MODEL NUMBER

DFA ☐ ☐☐ ☐☐ / ☐ – ☐ ☐ ☐ – ☐☐☐

- Blank= Concentric
  E= Eccentric
- **Housing Size**
- **Connection Size**
- **NEC Gas Group**
  B= Group "B"
  C= Group "C"
  D= Group "D"
- **Housing Material**
  C= Carbon Steel
  4= 304 S.S.
  6= 316 S.S.
  H= Hastelloy
  E= Exotic Material
- **Element Material**
  4= 304 S.S.
  6= 316 S.S.
  H= Hastelloy
  E= Exotic Material
- **Connection Type**
  F= Flat Face Flange
  R= Raised Face Flange
- **Options**
  1= Drain Plugs
  2= Temperature Probe Taps
  3= Pressure Taps
  4= Miscellaneous Fittings
  5= Protective Coatings
  6= Special Features

EXAMPLE: DFA [E] [1] [2] [0] [6] / [C] – [C] [4] [R] – [1] [2] [3]

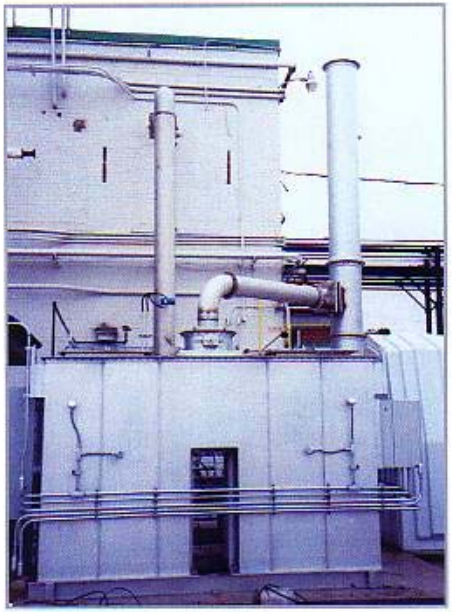
Indicates a 6" Eccentric Detonation Flame Arrestor with a 12" carbon steel housing, ANSI 150 lb. raised face flange connections, and a 304 stainless steel NEC Group "C" flame cell element. It also has options of drain plugs, pressure taps and temperature probe connections.

Revised (5/96)

EnviroAir Inc.

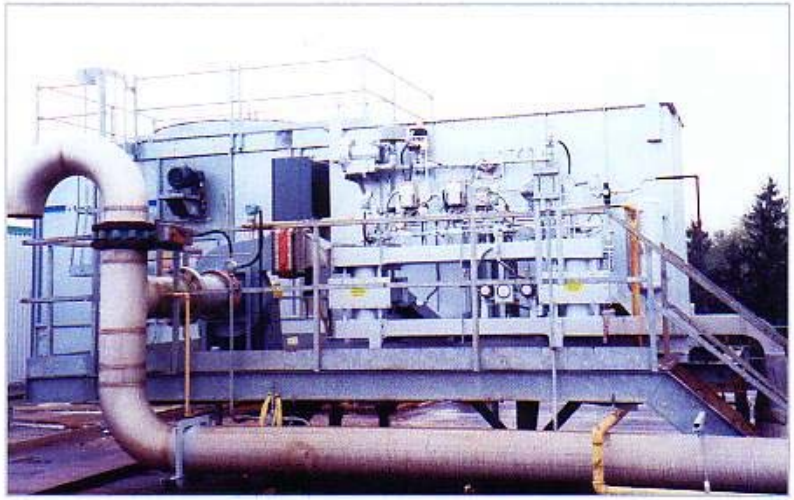
Thermal Oxidizer Systems

EnviroAir designs custom thermal oxidizer systems. We specialize in turnkey installations of environmental air systems. We can provide single source responsibility for the design, fabrication, installation and startup of your thermal oxidizer system.



The 2,000-scfm regenerative thermal oxidizer shown at left is removing toluene from process vents at a chemical manufacturing facility. This system was furnished with a hot gas bypass which allows operation with up to 25% LEL without overheating the system. A hot gas bypass damper on the top of the unit diverts a portion of the "cleaned air" from the combustion chamber to the stack without passing through the second heat recovery bed. The stack is specially designed to handle the higher temperatures.

The 35,000-scfm regenerative thermal oxidizer shown below is removing VOCs from the air exhausted from wood finishing operations. This RTO was furnished with a secondary heat recovery system which provides all the energy to heat 28,000-cfm makeup air for this facility.



Titanium Regenerative Thermal Oxidizer

The regenerative thermal oxidizer shown here and on the front cover is fabricated from Titanium. It is treating brominated hydrocarbons from process vents at a chemical manufacturing facility. The titanium construction is resistant to the highly corrosive hydrobromic acid gas created during the oxidation of the brominated hydrocarbons. The RTO system was furnished with a downstream packed bed scrubber with integral quench for removing the hydrobromic acid gas from the exhaust air before it is discharged to the environment.

Tank Level

- Enraf Tank Gauging & Control
- Innovative Sensors – Wireless Level

Intro Loading Automation

Fuel Management Systems

Terminal equipment

Contrec manufacturer a wide range of products for the measurement & control of fuel at the load rack, on-board vehicles, for re-fueling aircraft and at bulk fuel sites. These products enable fuel movements to be efficiently managed by reducing handling costs and accurately accounting for fuel stocks.

Intro Tank Gauging

Intro Tank Gauging & Control

Tank gauging is the generic name for static quantity assessment of liquid products in bulk storage tanks.

Tank gauging is essential for the assessment of tank contents, tank inventory control and tank farm management.

Level uncertainties of only 1 mm in a 10 meter tall, 50.000 m^3 tank already equals 5 mm^3, clearly indicating that accurate measurement is the prime requisite for good inventory management, however it is still only one of the many aspects involved in tank gauging.

Reliability to prevent product loss, performance to optimise products movements and safety to protect the environment and personnel are equally important.

Enraf provides a comprehensive range of products and systems for accurate tank gauging, inventory management and tank terminal operations.

Open connectivity, fit for purpose, modular design and solid migration paths are the keywords behind these offerings, enabling the optimum use of tank storage capacity to optimise operations and increase revenues.

The Enraf products and systems are approved for custody transfer and compliant with all major international standards.

Marine level gauges
Designed for gas carriers and special products

Enraf marine level gauges provide an accurate and reliable measurement of liquid levels in the cargo tanks of cryogenic, refrigerated or pressurized-gas tankers. These applications require reliable and robust instruments to cope with the adverse conditions of such service.

Features

The float-type marine level gauges are spring motor-driven instruments.
A small and light float is used as the level-sensing element. The gauge head is composed of two fully-separated compartments. One compartment is hermetically sealed and filled with oil. This compartment houses the spring motor, level indicator, float speed regulator, intrinsically-safe level transmitter, level alarm switches and a reference switch.

The other compartment is openly connected to the cargo tank and houses the measuring drum with measuring cable and float. The measuring drum is linked to the motor compartment through a magnetic coupling.

Special advantages for liquefied gas tankers
The sturdy level gauge housing makes the instrument very suitable for installation on gas tankers. If required, the level gauge can be mounted on a six-inch 150 lb gate or full bore ball valve. The float is sized such that it can be raised above the valve to allow a calibration check at any time without interrupting the tank service.

For pressurized gas cargo tanks, a medium-pressure (up to 0.6 MPa / 6 bar) level gauge or a high-pressure (up to 1.6 MPa / l6 bar) level gauge is available. For cryogenic tankers, the instruments can be provided with temperature- compensated measuring drums to correct for possible temperature errors.

Accuracy

The gauge's accuracy is ± 2.5+0.18L mm for the local indication and ±3.0+0.18L mm for the remote indication. (L is the height in meters.)

Repeatability is ± 2 mm for local indication and ± 2.5 mm for remote indication.

Because of the float's shallow immersion and the sensitivity of the gauge, a variation in product specific gravity of 100 kg/m3 results in an immersion variation of only 0.3 mm.

Remote indication

For centralized cargo handling, the level gauges can be connected to remote indicators and systems.

Innovative
SENSOR SOLUTIONS, LTD.

DataStik™

Wireless Level & Temperature

Proven Magnetostrictive Level Sensing Performance: Now Wireless and Battery-Powered

Innovative Sensor Solutions and ***Ametek Sensor Technology*** have teamed up to develop **DataStik™**: a truly wireless and continuous tank gauging system. It is ideal for storage tank inventory control in both aboveground and underground storage tanks.

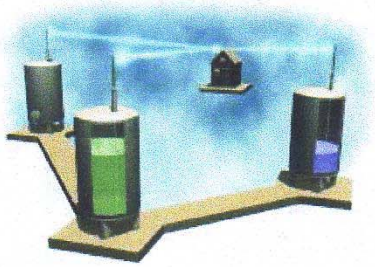
DataStik™ employs the patented battery-powered, intrinsically safe, 900MHz **DataCheck®** spread spectrum sensor power and control platform. Integrated with the *Ametek Process Technologies* Digital **Stik™**, the system provides continuous level and temperature measurement for inventory control and supply chain management. Since the system does not require power at the tank, it is ideal for monitoring tanks that have not had any electronic instruments installed or are in remote areas where it would be costly to bring power and signal wiring to the site.

DataStik™ is available in 2 formats to suit virtually any level monitoring application. The 316 stainless steel version is totally welded construction, and has a cathodic protection boot for use in a wide variety of applications. The flexible version employs a PVDF housing and provides very cost effective tank inventory monitoring in deep tanks (up to 50 ft.).

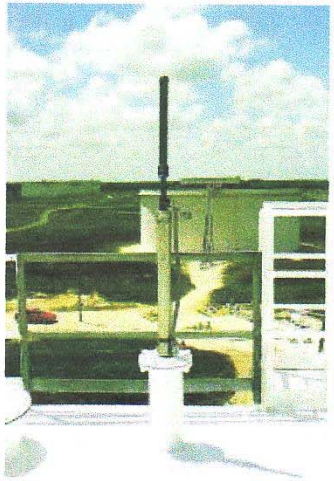
This breakthrough in package design eliminates the bulky electronics enclosure at the top of the sensor and offers greater options for insertion and mounting in tanks and vessels. In addition, continuous self-diagnostic system monitoring is part of the level measurement.

All **DataStik™** models provide 5 high resolution temperature measurements and the ability to add a lower, high density float to measure the level of the interface between the product and any water that may be present.

The **DataCheck™ Receiver** and **DataCheck™ System Portal** provide data to all popular terminal management, tank gauging, and HMI applications using the industry standard MODBUS-RTU protocol.



True "Stand-Alone" Tank Gauging
No power or wiring required!
Tanks up to 50 ft!



DataStik™ Installed on Storage Tank

AMETEK
PROCESS TECHNOLOGIES

Innovative Sensor Solutions, Ltd.
1718 Fry Road, Suite 435
Houston, TX 77084-5843 USA

TEL: (281) 828-1050
FAX: (281) 828-1050
www.innovative-sensor.com

Innovative
SENSOR SOLUTIONS, LTD.

DataStik™

Wireless Level & Temperature

Installing Flexible DataStik™
(for tanks up to 50 ft.)

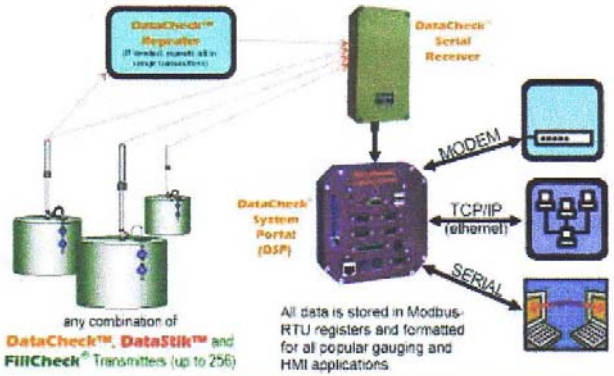
C SP US
Exia

ILTA SUPPLIER

Reference Specifications	
Power requirement	2 - 3.6 V lithium ion batteries
Sensor Length	Stainless steel: up to 24' Flexible PVDF: up to 50'
Enclosure Rating	Sensor: IP-68 Transmitter: IP-67
Level Resolution	0.25 mm (0.01")
Accuracy	±1.0 mm (±0.04")
Temp. Resolution	0.1°C
Temperature Accuracy	-10°C to +85°C ±0.5°C -40°C to -11°C ±2.0°C
Temp. Sensing Range	-40°F – 150°F
Operating Temperature	-40°F – 180°F
Approval	CSA US/C intrinsically safe approval, Exia
Spread Spectrum Scheme	Fully Supervised Digitally Encoded Frequency Hopping
Operating Frequency Range	Multiple independent channels, 902- 928 MHz ISM band
Protected Under	U.S. Patent No. 6,369,715
NOTE: Specifications may change without notice	

DataCheck™ System Portal (DSP)

PROVIDING GLOBAL SCADA ACCESS TO ALL *INNOVATIVE* WIRELESS PRODUCTS



any combination of
DataCheck™, DataStik™ and
FillCheck® Transmitters (up to 256)

All data is stored in Modbus-RTU registers and formatted for all popular gauging and HMI applications

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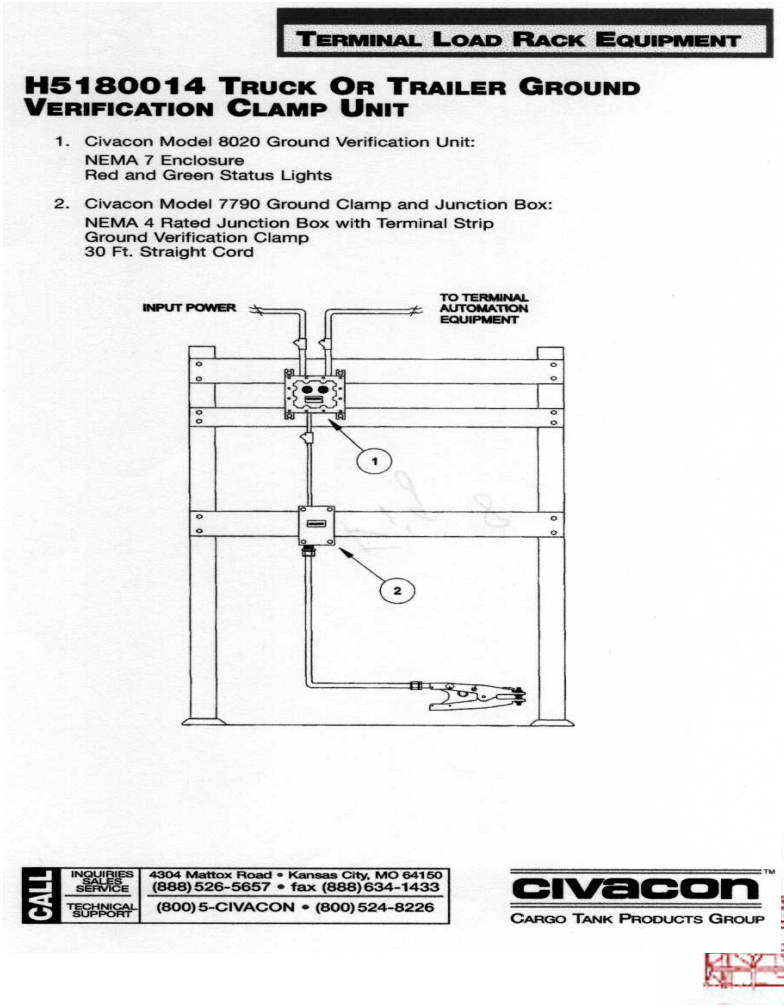
Safety

- Grounding Overfill Protection
- Safety Bridges
  - Catwalks
  - Dike Wall Stairs
  - Portable Stairs

Terminal Load Rack Equipment

- Safety when loading or off-loading ethanol is very important as a hazardous chemical.
- Grounding equipment on truck and railcar is recommended.
- Can be wired through a permissive to the pump start on a go/no-go basis for safe off-loading.



TERMINAL LOAD RACK EQUIPMENT

H5180014 TRUCK OR TRAILER GROUND VERIFICATION CLAMP UNIT

1. Civacon Model 8020 Ground Verification Unit:
   NEMA 7 Enclosure
   Red and Green Status Lights
2. Civacon Model 7790 Ground Clamp and Junction Box:
   NEMA 4 Rated Junction Box with Terminal Strip
   Ground Verification Clamp
   30 Ft. Straight Cord

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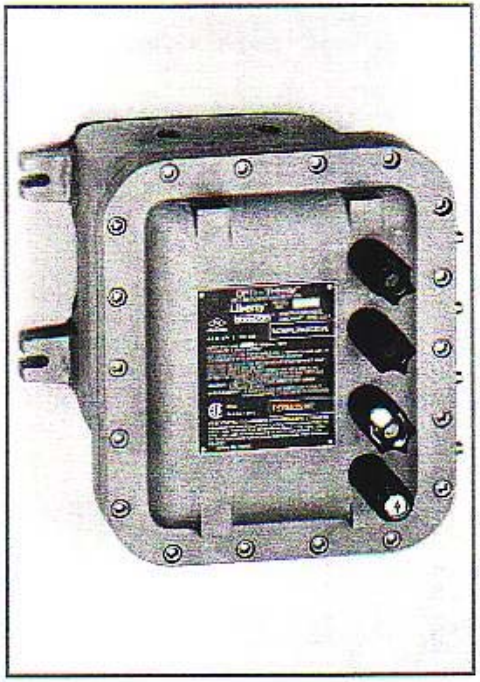
AUTOMATIC SWITCHING, OPTI-THERM RACK MONITOR

OPTI-THERM RACK MONITOR MODEL 8460



Civacon Opti-Therm 8460 Features:

- Automatic switching operation, no thinking or manual efforts required by your customers
- Optic and Thermistor technology in one package, eliminating your customer's concerns about which system technology they use on their transports
- Compatible with all 5-wire optic, thermistor, thermo-optic sensors. Will load all trailers equipped with any brand or style of overfill detection system
- Includes ground verification via a separate relay contact
- Overfill detection and ground verification are signaled to the terminal automation system (T.A.S.) separately, enabling maximum flexibility at the loading terminal without compromising safety

CALL TODAY...

Call Civacon today and make the "AUTOMATIC SWITCH" to the model 8460, Opti-Therm Rack Monitor... the only system you'll ever need at your terminal.

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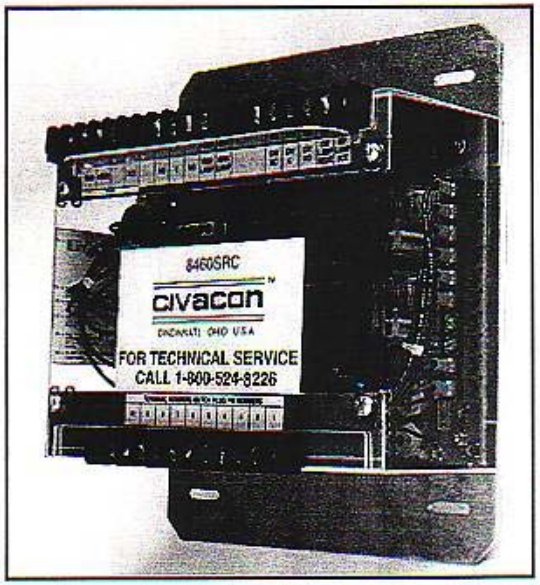
AUTOMATIC SWITCHING, SCULLY REPLACEMENT CHASSIS

EXTEND EQUIPMENT LIFE WITH OPTI-THERM MODEL 8460SRC REPLACEMENT CHASSIS



FEATURES & BENEFITS

- Upgrades Scully ST-6 or BICLOPS® rack control monitors with simple drop-in direct replacement chassis
- Provides Automatic Switching and Internal Ground Verification for API Optic and Thermistor technology, all in one package
- Easy installation, requiring simple hand tools; typically less than one hour downtime
- Accepts existing wiring from 120VAC power supply and control circuits, plus plug and cord connections

- Compatible with all 5-wire optic, thermistor, thermo-optic sensors. Will load all trailers equipped with any brand or style of overfill detection system
- Includes ground verification with additional set of contacts for installing an external ground verification status light
- Overfill detection and ground verification are signaled to the terminal automation system (T.A.S.) separately, enabling maximum flexibility at the loading terminal without compromising safety
- Suitable for Class I/Division1/Group D hazardous locations when installed per Civacon installation manual
- Covered by Civacon's 1-year warranty, with full factory service available

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TERMINAL LOAD RACK EQUIPMENT

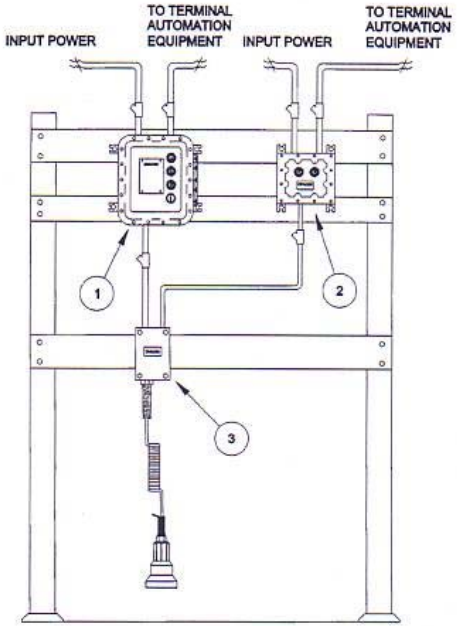
H5180008 OPTIC OR THERMISTOR TRUCK OVERFILL DETECTION UNIT WITH SEPARATE GROUND VERIFICATION MONITOR

For Use with Multi Compartment Tank Trucks or Trailers

1. Civacon Model 8140 Optic Format Control Monitor:
   NEMA 7 Enclosure
   Keyed Bypass Switch
   Red and Green Status Lights
   Amber Light to Indicate Bypass

2. Civacon Model 8020 Ground Verification Monitor:
   NEMA 7 Enclosure
   Red and Green Status Lights

3. Civacon Model 7190S Plug & Cord and Junction Box:
   NEMA 4 Rated Junction Box with Terminal Strip
   30 Ft. High Visibility 10 Conductor Coiled Cord
   Light Weight Molded Optic Plug



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Greenline **INDUSTRIAL LADDERS & LADDER CAGES**

Increase Operator Safety with Greenline Industrial Ladders and Ladder Cages

Greenline Industrial Ladders are specifically designed for applications where safe, solid vertical climbing is required. This can include loading platforms, storage tanks, loading docks, and various other applications that require vertical ladders instead of stairways as a solution to an access problem.

Standard fixed models can be used up to 20' without safety cages. OSHA regulations require the use of safety cages on ladder heights exceeding 20'.

All **Greenline** Industrial Ladders meet or exceed OSHA Standard 1910.27, as we interpret it, when exceeding the height for ladders without cages or upgrading existing ladders. The **Greenline** one piece welded steel cages will provide the operators the safety required for accessing these applications.

Greenline Industrial Ladders and Cages are manufactured from carbon steel. Green Manufacturing, Inc. can design a ladder system to meet any application that your operation would require.

Listed below are several of the features designed into our Industrial Ladders and Cages.

- Structural side members to provide the maximum load requirement.
- Ladder rungs are designed for the maximum load bearing capabilities under the OSHA standards, as we interpret them.

- Stand-off brackets insure that operators have adequate room for a good foot hold when accessing a structure.
- 1" diameter rungs for ease of ascending or descending our ladder systems.
- Optional security ladder guards to prevent unauthorized use.
- Optional security ladder gates prevent unauthorized use to caged ladder systems.
- A variety of finishes are available from the standard red oxide primer to hot dipped galvanizing.
- **Greenline** ladder systems can be mounted to a variety of existing structures.
- Safety cages are designed to OSHA specifications as we interpret them with flared bottom opening for ease of entry.
- Directional cages are available for ladder systems that exceed 30' in overall height and require a stand-off platform.
- Stand-off platforms for ladders that exceed 30' for compliance to OSHA 1910.27, as we interpret it.

Call us today.

Green Manufacturing, Inc.
1032 S. Maple Street
P.O. Box 408
Bowling Green, Ohio 43402-0408
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Greenline
PIPE & DIKE BRIDGES

Designed to Provide Your Operators Safe Access

The **Greenline** Pipe & Dike Bridges are specifically designed to provide safe passage for workers who are exposed to serious fall hazards due to unsafe means of crossing over piping, dikes, various containment walls, conveyors, or production lines. Safety and reliability are our main objectives when designing pipe & dike bridges for your clients or customers.

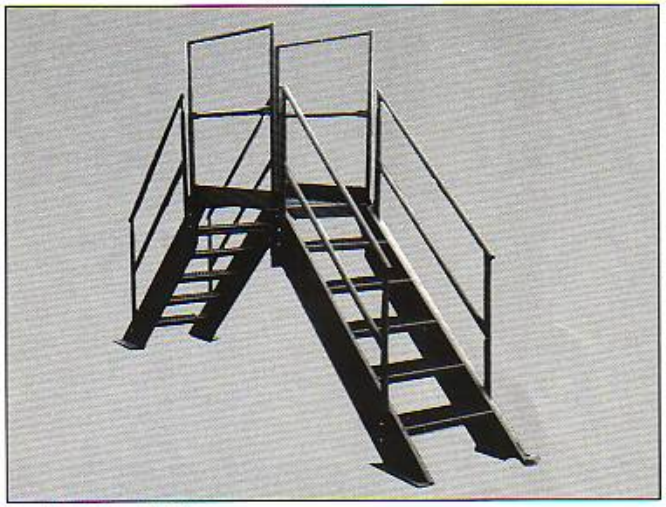
The basic Pipe & Dike Bridge design can be changed to fit any application. The materials of construction include carbon steel, aluminum, and FRP (fiberglass). Given the opportunity, Green Manufacturing, Inc. can supply a pipe & dike bridge to solve any crossover problem.

Listed below are several key features designed into each **Greenline** Pipe & Dike Bridge.

■ **Engineered for safety** Designed to comply with the governing OSHA standards, as we interpret them. Decking and stair treads are non-slip perforated construction. Fall protection, such as toeplates and handrails with midsections provide safe access over various applications.

■ **Several types are available** Each pipe & dike bridge is primarily designed to your applications ranging from 3' to several feet long.

■ **Manufacturing** All bridge assemblies are manufactured and assembled by our certified welders. Each welder is certified to the American Welders Society, AWS D1.1 code.



Pipe & Dike Bridge 2' x 3' x 4'

■ **Increased durability** Platforms are welded assemblies constructed primarily of carbon steel. Access stairs are welded assemblies also providing the maximum load bearing capabilities for even the most critical design application. Our pipe and dike bridges are available in any combination of designs and materials of construction to fit the application.

■ **Finishes or coatings** Each system is available in a variety of finishes. Our standard finish is red oxide primer. As options, silicone base paint finishes or hot dipped galvanizing after fabrication is available.

■ **Cost effective** Assembly is cost effective in terms of time and money since all pipe and dike bridge systems are preassembled and thoroughly checked. They are then disassembled for shipment. Each bridge system is designed with typically three major components to reduce your set-up time. Some smaller systems can be shipped to the job site fully assembled.

■ **Ease of installation** **Greenline** Pipe and Dike Systems can be assembled by your plant maintenance personnel with the aid of our assembly instruction package. With the basic bridge system consisting of 3 major components, assembly can be completed in approximately 4 man hours after installation of the foundation.

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Greenline **PORTABLE STAIRWAY**

Fall Protection Unsurpassed by Others

Greenline Portable Access Stairways are specifically designed for various industries and applications that require accessing the top of a vehicle. The **PLS series** is designed to hydraulically raise and lower to the correct height to provide the safety required. The **PLR series** is designed with either safety bridges or safety stairs for the primary access to the vehicle being serviced. The **Greenline** Portable Access Stairways were developed to provide a safe and effective solution to various applications that require flexibility.

Greenline Portable Access Stairways provide safe access from grade to an elevated area during a loading / unloading process. To complete the PLS stairways and provide your operators the fall protection required when accessing the truck tops, a 3' square safety hoop is supplied to encompass the dome area of the truck. Our stairways are designed with non-slip grip strut treads and serrated bar grating on the walking surface of the platform.

Greenline Portable Access Stairways can be manufactured from carbon steel, aluminum, and fiberglass (or a combination of each).

PLS-12 Portable Access Stairway

Green Manufacturing, Inc. can design a stairway to meet any application that your operation requires. The uniqueness of our design allows us to arrange or modify various stairways to meet your requirements.

Maneuvering the portable access stairways is accomplished in a variety of ways. The smaller systems can be placed into position manually or driven in place by a motorized vehicle.

Each unit is equipped with a hydraulic ball valve to maintain the fluid pressure during storage periods when the facility is not being used.

Greenline Portable Access Stairways, Safety Systems and other Greenline products are designed and manufactured to fit your specific application. With Green, you not only get quality products, you also get years of dedication and service to the industry for providing dependable access systems. Let Green be your problem solver when it comes to access problems. Specify **Greenline** today.

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Greenline **SAFETY STAIRS**

Bridge the Gap Between Safety and Liability

Greenline Safety Stairs are specifically designed for various industries and applications that require accessing the top of a vehicle. The safety stair is designed for applications where the working range exceeds angles greater than 15 degrees above or below the platform height. The **Greenline** Safety Stair provides a solution for various applications where access is a problem.

Greenline Safety Stairs provide safe access from the loading rack or dock to an elevated walkway during a loading/unloading process. Our safety stairs are designed with non-skid self-leveling grip strut treads.

Greenline Safety Stairs can be manufactured from carbon steel, aluminum, and fiberglass (or a combination of each). Green Manufacturing Inc. can design a safety stair to meet any application that your operation would require.

Maneuvering the safety stair is performed by hand. Simple and compact tension spring balance method makes all movements easy. A slight push or pull positions the stair for safe access to the vehicle. Each unit is equipped with a locking mechanism for storage in the vertical position.

Combine these features with several advantages listed below to make **Greenline** your choice.

- Folding tubular handrails with midrails on each side of the stair for increased operator safety and compliance with OSHA standards as we intreprat them for 200 lbs. directional force.

SS404 Aluminum Safety Stairs

- Neoprene bumpers to eliminate damage to the vehicles being serviced.
- Main axles are equipped with self aligning permanently lubed bearings. The self-leveling tread axles on aluminum models have bronze bushings for low maintenance.
- A variety of finishes are available: standard safety yellow enamel, hot dipped galvanized, uncoated or anodizing for aluminum models.
- Optional side mount brackets make side mounting to your existing structure easy.
- Optional welded stops prevent the stair from traveling beyond a predetermined position.
- Larger models may require the use of a manual or electrically operated hydraulic lift package.
- Tension springs are enclosed in the side panels to prevent pinch points and corrosion to the springs.

Electronic Control Systems

- Management Systems – complete
  - Security
  - Accounting
  - Record Keeping
  - B.O.L. Generation

  (or)

- Distributed Control
  - Electronic Preset
  - All “Real Time” Functions
  - Pump Control / Valve Operation
  - Temperature Compensation
  - RS 485 / 232 Communications to the system
  - Ground / Overfill Interface
  - Loading Control Valve Control

Complete Management Systems

- Accounting / Customer Base
- Allocation Record Keeping
- Security – Customer / Access and Authorization
- Record Keeping – Daily Reporting, Tax, Inventory, Process
- B.O.L. – General Bill Of Lading Generation, once all required certification i.e. Trust Insurance are met…. System will allow access to Truck allocation than generate the B.O.L. by polling the loading rack equipment Data Base.
- Pro's – A very attractive option one source delivers the computers accessories and customized your system to your needs. Can grow as necessary.
- Con's – If not ordered properly can by the Achilles Heel of the system with shut-down of facility potential. A Blended system is best choice

Distributed Control

- Allows the use of equipment specific to the task with communications Interface back to the management system.
- Electronic Preset
  - Driver Interface – Product Recipe / Name - Pump / Valve
  - Temperature Compensation - Ground / Overfill Emergency Control
  - Optional Additive Control
- Grounding / Overfill
  - Monitor – Checks Truck / Operations operation - Ties back to the Preset and System (ESD)

  Additive Injection / Micro Blend Controllers
  - Ties back to Management System
  - Configurable for Alarm action designated by the customer
- Vapor Control Equipment
  - Ties back to the Management System - Performance critical
- Pro's
  - Application Specific
  - Flexible System Could operate (Emergency) Stand alone
- Con's
  - Cost – need to understand each component task / advantage

Pulse Subscription

Sign up for the **Toptech Pulse** Newsletter

Technical Reviews

- TMS-Mirror vs. RAID
- MultiLoad Additive Control Strategy
- Why Your Customers Want TDS

Toptech News

- Toptech's ACR (Access Card Reader) Now Available (Feb 11, 2004)
- Toptech Breaks New Ground (Literally) (Feb 11, 2004)
- Toptech Europe Signs Agreement to Automate Five Van der Sluijs Terminals in 2004 (Dec 30, 2003)
- Registration now Open for Toptech's International User Conference (Dec 03, 2003)
- Toptech Develops Access Card Reader (ACR) (Dec 03, 2003)
- Toptech Participates in Orlando Magic Golf Scramble for Local Charity (Dec 03, 2003)

Toptech offers complete line of software and hardware solutions for the bulk ter industry. Our products and services include load rack control, terminal control, control and industry control.

TMS5 - Toptech's highly modular and configurable Term Management System. This PC-based, real-time, networ turnkey solution meets and exceeds the most demandin terminal automation and management requirements.

TMS-HOST - Toptech's Terminal Management System fc terminal environments. TMS-HOST is a centralized versi TMS5 designed for applications where load transaction c multiple terminals is routed to a corporate host system.

TopHAT - TopHAT can turn your data into accessible kn with Data Management, Data Mining, and a powerful Da Warehouse. TopHAT provides fast, easy access to both h and current detailed corporate information that may oth be locked up in complex ERP and legacy systems. TopH designed to fit easily into your corporate IT strategy, pr an interface between TMS/TMS-Host and your corporate system.

MultiLoad - "Making Traditional Presets Obsolete." Toda integrated approach to load rack control is available in t Toptech MultiLoad. The MultiLoad is an extremely flexibl modular system that performs all preset, additive, and reading functions for an entire lane.

RCU - Toptech's popular Remote Control Unit (RCU) is a purpose industrial data terminal designed for data entry driver/operator interaction at various locations within a facility.

veriFID - To address the need for increased terminal sec Toptech has developed a fingerprint verification device veriFID. veriFID is a reliable, cost-effective solution that work for everyone, everywhere, even under the most

Application: Ethanol Blending with MultiLoad

Introduction

Prompted by concerns regarding MTBE, the petroleum industry is currently undergoing a massive shift to use ethanol as an oxygen-enhancing additive for gasoline. Since ethanol is readily miscible in water, the blended product must be kept away from any sources of water, i.e., pipe lines, barges, ships, etc. For this reason, ethanol will typically be blended at bulk storage terminals during truck loading. This document describes how MultiLoad can be used to control the blending of ethanol.

For ethanol blending, Toptech recommends ratio blending directly into the truck at the load rack since this is the only current method where ethanol expansion is not a factor in balancing rack throughput to tank balances. Unlike most petroleum products loaded at gasoline load racks, when ethanol is blended with gasoline, it expands beyond the sum of the individual components; in other words, 900 gallons of gasoline and 100 gallons of ethanol do not equal 1000 gallons of blended product. (This volume expansion is different than the thermal expansion that also affects petroleum products.) Currently, there are no API tables to calculate a volume correction factor when mixing ethanol with gasoline. For this reason, Toptech does not recommend blending ethanol BEFORE the point of custody transfer. However, by ratio blending gasoline and ethanol onto the truck, volume expansion occurs AFTER the point of custody transfer and the expansion is not a factor in balancing rack throughput to tank balances.

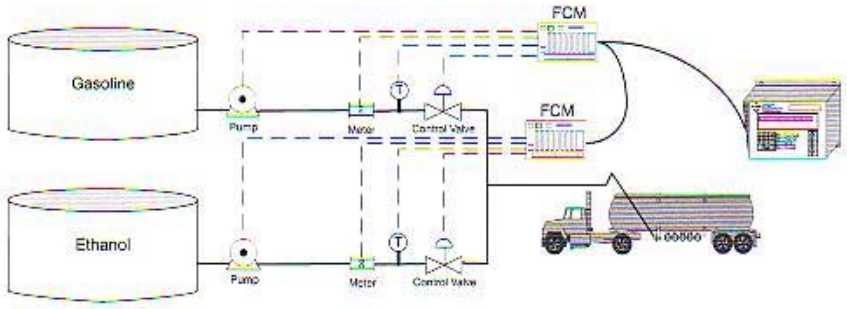
Description

Toptech's TMS5 and MultiLoad are ideally suited to control ethanol blending. For new or refurbished load racks, MultiLoad's distributed architecture makes it much simpler and less expensive to install than traditional electronic presets. MultiLoad is designed to handle all driver/operator interaction and I/O control at the loading rack. MultiLoad can also handle the tight tolerances that are required for blending ethanol.

MultiLoad can be configured to control ethanol blending in a variety of methods including:

Ratio Blending: MultiLoad can be configured to handle up to 6 component ratio blending. As mentioned above, Toptech recommends ratio blending at the load rack since this is the only current method where ethanol expansion is not a factor in balancing rack throughput to tank balances. In this scenario, a MultiLoad RCU is installed on each bay at the load rack, and an FCM panel is installed at each bay to handle the discrete I/O. The MultiLoad serves as the driver interface, card reader, and electronic preset. By ratio blending the gasoline and ethanol onto the truck, there are two points of custody transfer: straight gasoline and straight ethanol. Most importantly, volume expansion occurs AFTER the point of custody transfer and is not a factor in balancing rack throughput to tank balances.

Ratio Blending



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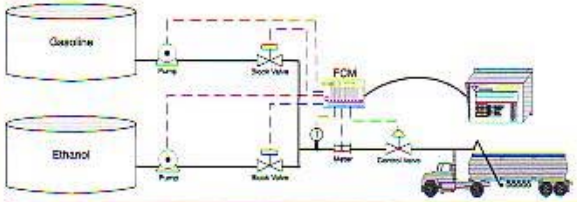
Toptech Systems, Inc.

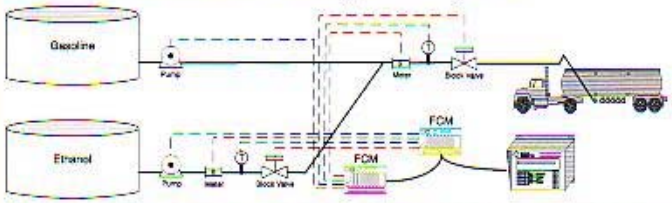
Application: Ethanol Blending with MultiLoad

Sequential Blending: MultiLoad can be configured to handle up to 8 component sequential blending. In this scenario, a MultiLoad RCU is installed on each bay at the load rack, and an FCM panel is installed at each bay to handle the discrete I/O. The MultiLoad serves as the driver interface, card reader, and electronic preset. Sequential blending is not recommended because if a situation arises where a load is stopped before completion, the blended product on the truck may fall outside of acceptable tolerances. For many terminals, there is no acceptable location to pump back this off-spec product. An additional complication of sequentially blending ethanol is that gasoline and ethanol are highly immiscible, so you are forced to rely on the mixing to occur as the product is delivered to it's destination.



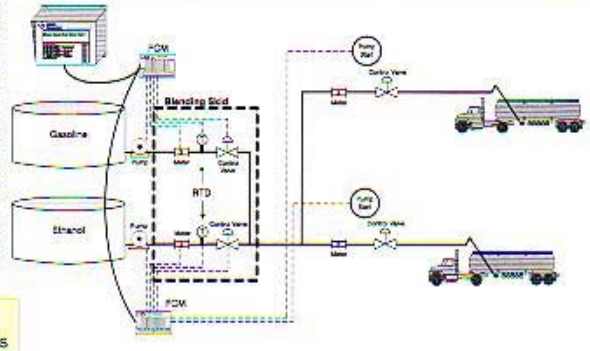
Sequential Blending Issues:
- Pump back of off-spec blending
- Ethanol/Gasoline Immiscibility

Sidestream Blending: Sidestream is similar to ratio blending in that two or more components are delivered simultaneously to achieve a blended product. In a sidestream configuration, however, the ethanol component is delivered upstream of the gasoline (custody transfer) meter. In this scenario, the sidestream seeks to maintain its rate at a preprogrammed ratio of the rate that is flowing through the gasoline meter. The problem with using sidestream blending for ethanol is that there are no API tables to calculate a volume correction factor when mixing ethanol with gasoline



Sidestream Blending Issues:
- No API tables for ethanol/gasoline blends

Wildstream Blending: MultiLoad can be used to blend ethanol into all the product flowing from a gasoline tank to the load rack. This method of blending is similar to the wildstream blenders that blend high and low octane gasoline to make midgrade. In this scenario, MultiLoad waits for a flow signal from each preset at the load rack. As soon as product begins flowing, MultiLoad controls the proper ratio of ethanol being blended into the gasoline. As more presets come on-line, MultiLoad continuously maintains the proper blend. The problem with using wildstream blending for ethanol is that there are no industry accepted tables to calculate a volume correction factor when mixing ethanol with gasoline.



Wildstream Blending Issues:
- No API tables for ethanol/gasoline blends
- Difficulty in maintaining blend tolerances

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Application: Rail Car Loading with TMS5 and MultiLoad

Introduction

TMS5 and MultiLoad can be used in a variety of load rack applications including truck loading, barge loading, and railcar loading. This document describes how MultiLoad can control the loading of petroleum or chemicals liquid products into railcars. MultiLoad can be configured for use in either a stand-alone or remote controlled mode. For this discussion, it is assumed the MultiLoad package will be remotely controlled by and connected to a TMS5 terminal management system via a standard communication link (RS-485).

MultiLoad FCM Cabinet

Description

MultiLoad is designed to handle all driver interaction and I/O control for a railcar loading site; the driver interface is handled through the MultiLoad RCU, and all the I/O is handled through MultiLoad FCM's. One MultiLoad RCU can handle up to 7 railcars either on a single track or on multiple tracks. Some customers may prefer to install one RCU per track to simplify access for the loader. Each FCM handles one meter and up to four additional digital I/O points. Up to 32 FCM's can be controlled by a single RCU. With MultiLoad's distributed architecture, each FCM can be installed at a different location thereby minimizing electrical wiring. This method of installation can greatly reduce electrical installation costs. Another advantage of using MultiLoad is that PLC's or other expensive control devices are no longer needed.

Operation

Not only is MultiLoad very simple to install and configure, it is also very easy to use. Typically, the loading process begins by a loader gaining access to the RCU either by presenting a card or entering a loader number. The loader then selects the rail car to load and verifies a quantity from an order or enters a quantity of product to load. Once loading begins into the first railcar, additional railcars can be set up and loaded. These loads can occur simultaneously providing there is sufficient pumping capacity. For large operations with multiple pumps, TMS5 can control pump staging. MultiLoad also monitors the entire loading process including desired flow rates, desired fill volumes/weights, permissive circuits, and safety shutdowns. Any problems occurring during the loading process are written to an event log. Once product loading has ended, MultiLoad sends the completed transaction information to TMS5 for reporting purposes.

MultiLoad RCU

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Toptech Systems, Inc.

Application: Rail Car Loading with TMS5 and MultiLoad

MultiLoad Features and Benefits

Low Installation and Operating Costs
MultiLoad replaces the need for separate card readers, user interfaces and control devices (electronic presets/PLC's). MultiLoad's distributed architecture minimizes the cost to run discrete I/O wiring. Repair and maintenance are also simple; troubleshooting can be accomplished either through the RCU interface or remotely through TMS5.

Flexible I/O Control
MultiLoad handles all I/O thereby eliminating the need for PLC's or other expensive control devices; MultiLoad controls all pumps, status/permissive signals, meters, valves, temperature probes, additive injectors, etc. MultiLoad also handles a variety of product meters including PD meters, turbine meters, and mass-flow meters.

Powerful User/Loader Interface
The MultiLoad RCU includes a card reader, full alphanumeric keypad, and a 16-line display with graphics. RCU prompts can be configured for a variety of loading applications. During loading, the RCU also displays product loading information for the loader.

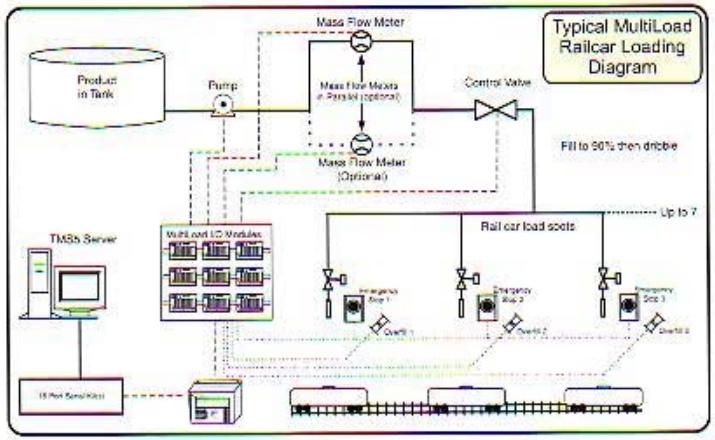
Single Point Diagnostics
The MultiLoad RCU displays important diagnostic information including I/O status and alarm information.

Remote or Stand-alone Operation
MultiLoad can be used in stand-alone mode if communications is ever lost with TMS5. Loader prompts, product information, and transaction information can all be stored in MultiLoad until communications is restored.

Product Reconciliation
TMS5 and MultiLoad make it easy to take control of product movements. Numerous features are available to account for every gallon of product into and out of your facility.

Better Utilization of Manpower
TMS5 and MultiLoad simplify the process of running a terminal. End-of-Day and End-of-Month processing are greatly simplified.

Simplified Long Term Support
MultiLoad is highly configurable and scalable. Additional I/O can be installed and configured without any custom or site-specific programming as is typically required with PLC's.



Application: MultiLoad Bunker Fuel Blender

One of the largest independent petroleum products and specialty liquids terminaling companies in the world recently installed Toptech's MultiLoad for a specialized bunker fuel blending application. Using MultiLoad and TMS5, Toptech's Terminal Management System, this customer can easily create customized bunker fuel recipes each time a barge is loaded. The entire process of building a custom recipe is completed on the dock in a matter of minutes. Once the recipe is built, MultiLoad controls each component of the blend to ensure that the loaded product matches the recipe.

Operation:

After gaining security access and entering customer and account information, the operator is asked to enter a preset quantity and define the requirements for the blend. A blend will consist of three liquid components. The operator will identify the tank, product and percentage of each component. The operator will also select the flow meter that will deliver each component of the blend. The blend is then delivered to the desired specifications.

Project Requirements:

Products from a group of tanks are to be blended through three metering streams into a barge. Since the tanks are not dedicated to any one product, the terminal needs the flexibility of delivering the contents of any tank through any of the three meters. The demand for flexibility is compounded by the tremendously large number of recipe (blend) variations that are to be delivered into the barge.

The different products must be able to flow through different meters on different occasions, depending on the tank in which the product happens to be stored. Additionally, the product may have to flow through a smaller meter on one occasion, if that product is a small percentage of the total blend. On another occasion, if the product is a large percentage of the blend, it may need to flow through a larger meter or through a combination of meters.

Project Obstacles:

Control Hardware

The traditional electronic-preset model is not capable of accommodating the automatic assignment of tanks and products to various flow meters. This could not be done without reprogramming the control devices each time the conditions change. Changes in the product/meter assignment must be made frequently, making reprogramming impractical.

This customer uses MultiLoad to blend custom bunker fuel into barges

Using a programmable Logic Controller (PLC) to manage the flow control hardware would require an expensive, custom program. Beyond the initial customization cost is the cost of using third party consultants to maintain the program and make changes as the terminal grows. Over time it becomes difficult to maintain unique, customized PLC logic as companies lose the originators of the program.

A control device is needed that has the flexibility of a PLC and the supportability of an electronic preset. The customer wants to be able to be self sufficient in adding meters and valves to the system as their operation grows.

Blend Database

Several families of blended products are produced. Each family consists of an unlimited variety of blends. Most of the blends in a particular family differ by only one percent. Frequently, recipes are created on the spot to meet a changing condition. Maintaining a recipe database would be a daunting task and it would be a nightmare for the operators to select the desired blend from thousands of possible variations.

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Toptech Systems, Inc.

Application: MultiLoad Bunker Fuel Blender

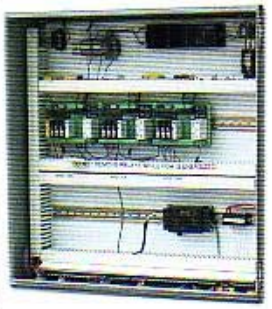
Project Solution:

Using Toptech's MultiLoad and TMS5, this customer is able to employ a configurable control device (MultiLoad) and a flexible interface (TMS5) that permits the spontaneous creation of recipes and the spontaneous assignment of products to meters, at the beginning of each load.

System operators configure the blends at the MultiLoad RCU. Prior to loading, operators get the blend instructions from the front office. During the authorization process, the operators tell TMS, through the MultiLoad interface, which tank and blend component will be used to deliver product through each meter. The percentage of each blend component is also specified at this time. The newly created blend instructions are sent back to the MultiLoad, which controls delivery and maintains the blend ratio.

Before

After



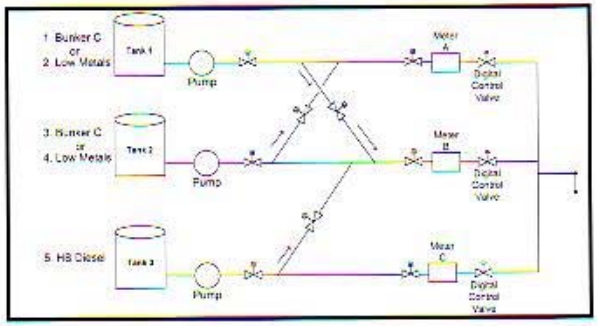
Configuration:

The diagram below illustrates the hydraulic configuration.

Tank 1: This tank typically holds two different products (blend components). Product in this tank can be delivered through Meter A, Meter B or through both A and B simultaneously.

Tank 2: This tank typically holds two different products. Product in this tank can be delivered through Meter A, Meter B or through both A and B simultaneously.

Tank 3: This tank typically holds one product. Product in this tank can be delivered through Meter A, Meter B, Meter C or



Applications:

The functionality of this application is not limited to the constraints of this example. Six flow meters can be assigned to each loading arm and eight different liquids can be assigned to each flow meter. Fourteen loading arms, consisting of multiple flow meters, can be supported with this one device. Totalizers of all the different blend components remain segregated in the MultiLoad to help protect the integrity of the delivered inventory.

GLOBAL SOLUTIONS FOR TERMINAL AUTOMATION

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Inventory Control

- Getting the correct volume numbers is critical for systems in order to monitor your loss, gains and leak detection.
- Look at where your totals come from and how you apply the compensated product volumes.
- Identify where you take the product temperature versus the location of your measurement device.
- Product temperature and the lack of API correction tables once products are blended is the most common issue when inventory control questions arise.

- Note: Product expansion per degree F change between gasoline and ethanol are close, similar growth over 10°F shift/ 25°F shift.
- Not so when blended. Ratios are taken into consideration.
- The TC - Temperature Compensated gasoline and an uncompensated ethanol can introduce a large error percent into your inventory accounting with a simple change of 10 to 25 degrees F, a common morning to evening change in one day.

Expansion Per Degree F	10	25	50	75	100
Gasoline 0.00067	0.00670	0.01675	0.03350	0.05025	0.06700
Ethanol 0.00062	0.00620	0.01550	0.03100	0.04650	0.06200

Effect Of Temperature on Blend Ratio

	5.70%	5.70%	5.70%	5.70%	5.70%
TC corrected Gas and uncorrect	5.665%	5.612%	5.523%	5.435%	5.347%
Blend % Error	5.735%	5.788%	5.877%	5.965%	6.053%
	10.00%	10.00%	10.00%	10.00%	10.00%
	9.938%	9.845%	9.690%	9.535%	9.380%
	10.062%	10.155%	10.310%	10.465%	10.620%
Gas and Ethanol At Same Temp	0.00050	0.00125	0.00250	0.00375	0.00500
Blend % Error					
	5.70%	5.70%	5.70%	5.70%	5.70%
	5.697%	5.693%	5.686%	5.679%	5.672%
	5.703%	5.707%	5.714%	5.721%	5.729%
	10.00%	10.00%	10.00%	10.00%	10.00%
	9.995%	9.988%	9.975%	9.963%	9.950%
	10.005%	10.013%	10.025%	10.038%	10.050%

LUBRIZOL Performance Systems

- If you use a compensated gasoline and think, why bother to compensate the small volume of the ethanol and blend them together, you will look all over for that product blaming vapor growth due to heat or leaks, proving your meters trying to identify or even repeat a loss or gain.

- But if you noticed the ethanol and gasoline at the same temperature uncompensated prior to the blend, they were close over that same 10-25° common temperature day.

- Answer: For best accounting, use a temperature as close as possible to the accounting meter.

- Have a meter compensated on your gasoline and one on your ethanol product compensated or both uncompensated.

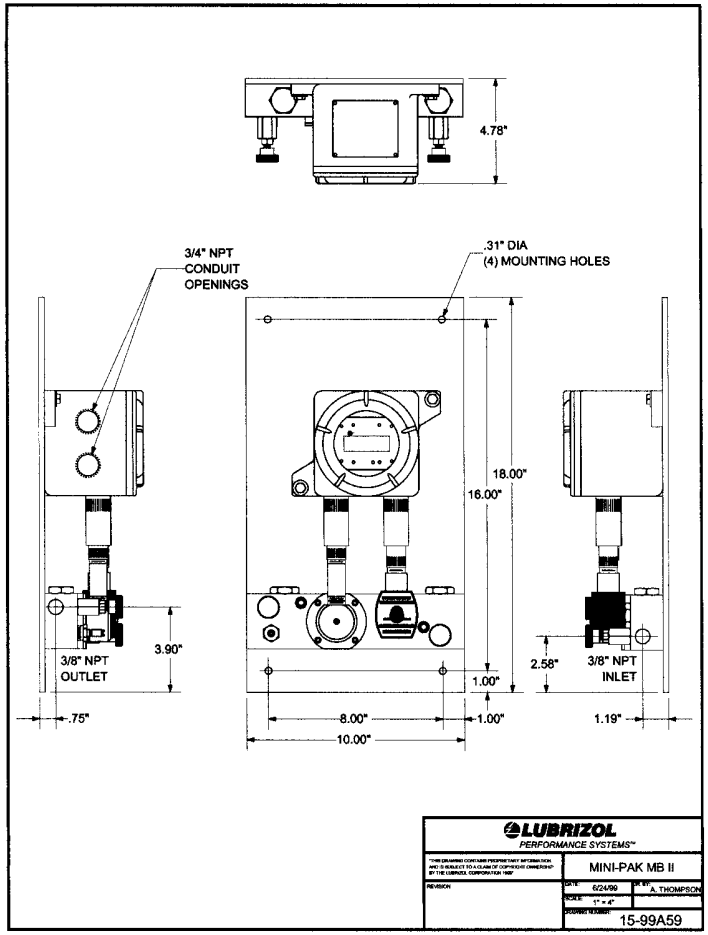
- When you deliver to the customer through an electronic preset and have a compensated volume, you will have the gross volume also available for each product to accurately adjust your inventory and not try to back in to a number.

Proving Ethanol Equipment On Load Rack

- Typical single product meters are proved at least annually by a Third Party Prover, to meet Weights & Measures regulations.
- Blended Product is recommended to prove each meter prior to blend to get actual volumes product K-factors, then pump back unblended product to storage.
- On Blended Product, at least annually, this is required by Weights & Measures. This product can be blended as normal than with loading arm attached to a Small Volume Prover. Calibrate the delivery meter and pass on through a hose connection into the typical delivery truck (no pump-back to Transmix).
- For best accuracy, be sure to check your meters often and verify your K-factors. Consider seasonal changes in temperature also very important in Sequential Blends that you are using the proper factor for each component.

Additives Injection

- Typical Additive Injector Control Panel Blend Pak® Mini Park® Micro - Dose Pak ®
- Denaturant - 5% to neat 100% alcohol upon receipt. Record product (alcohol) volume from meter and the Denaturant Natural gasoline volume. Excellent for your paper trail/reporting for Bureau of Alcohol, Tobacco and Firearms.
- Corrosion Inhibitor - Away from off-load point utilize pulse output from receiving meter to "pace" additive on the way to the tank.
- Same option for anti-static.
- Note: Whenever you inject gasoline additive on the load rack or into the blend, **NEVER** pipe to inject into 100% Ethanol, creates BEEBEE's or lacquer, **BAD** for meters.



Summary Checklist

1. Identify Source - Quality Control of Ethanol produced.
2. Contract should cover the denaturant produced and percentage.
3. Request:
   - Product Proof - ATBF reporting table.
   - Product specific gravity before and after denaturant.
   - Certificate or test data on water concentration when shipped.
4. Transport - Clean tankage, non-contaminated product.
5. Receipt - Consider density slip stream, continuous monitoring to insure what you are receiving.
6. Design your receiving system to eliminate air. Measure and control for accurate accounting.
7. Blending across your load rack - best option, for you.
   - Ratio
   - Sequential
   - Off Rack
8. Inventory Control - Where do you take your temperature? Do you control and account by gross or net volume

Summary Checklist - *(continued)*

9. Accounting - Remember you have many governmental requirements. Your accurate inventory practices will help you meet these reporting and regulating demands. The equipment is available to meet these demands.

10. Proving - Remember that the meter is often the cash register and you should prove this equipment as often as necessary to guarantee your quality control and inventory practices.

11. Safety - Check to be sure grounding of truck and rail cars is incorporated into your design. Consider your actual product handling are hoses or arms, your best option for speed and injury prevention. How will your truck or rail car connections meet a no drip policy when off-loading and clearing your delivery hose?

12. Emission - Remember when you order any equipment that you will be handling ethanol and that you advise the supplier of your application.

Thank You For Your Interest

Kathy West
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